



**AIS UTILISATION IN ICCAT BY
EUROPEAN-FLAGGED FISHING
VESSELS BETWEEN 2018 - 2021**

OM 23 - 010



OceanMind 23 – 010

AIS UTILISATION IN ICCAT BY EUROPEAN FLAGGED FISHING VESSELS

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Abbreviations

AIS	Automatic Identification System	ICCAT	International Commission for the Conservation of Atlantic Tunas
AOI	Area of Interest	MMSI	Maritime Mobile Service Identity
EEZ	Exclusive Economic Zone	RFMO	Regional Fisheries Management Organisation
EU	European Union	SOLAS	International Convention for the Safety of Life at Sea
HRA	High Risk Area	VMS	Vessel Monitoring Systems

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Executive Summary

This report summarises the analysis of Automatic Identification System (AIS) utilisation from 145 longline and 82 purse seine fishing vessels, which were above 25 m and ICCAT authorised. It focuses on the transmissions from 4 EU flag-states, demonstrating some level of possible fishing activity within the Atlantic Ocean, for the period 01Jan2018-31Dec2021 (1,461 days).

While longline fishing vessels showed substantially lower gaps in AIS transmissions (85.75 days¹) compared to purse seine vessels (184.4 days¹), there was large variability between flag states and between individual vessels. To account for this variability, the summary of individual flag-states below will emphasize quartiles of data sets rather than full ranges.

Summary analysis of Spanish-flagged vessels

The Spanish-flagged purse seine (n=40) and longline (n=124) vessels were operational in the analysis period for a possible maximum of 232,709 transmission-days² (with a possible maximum per vessel of 1,461 days). Nine vessels had no transmission in some years and one vessel reflagged to France in 2021. Consequently, the respective years were not considered for these vessels. Based on analysis at fleet- and vessel-level, the following conclusions can be drawn:

- I. When vessels operated outside of their own Exclusive Economic Zone (EEZ), purse seine vessels transmitted mainly on the West African coast north of the Gulf of Guinea. Some of the smaller vessels operated in European Union (EU) EEZs between the north of Spain and Ireland. Longliners primarily operated in the International Commission for the Conservation of Atlantic Tunas (ICCAT) high seas.
- II. The purse seine fleet transmitted on 22,189 days (39.5%) and the longline vessels on 133,287 days (75.4%), which corresponds to a total of 155,476 days (67%).
- III. The purse seine fleet did not transmit on 34,060 days (60.5%) and the longline vessels on 43,493 days (24.6%), which corresponds to a total of 76,156 days (33%).
- IV. For figures specific to Spanish purse seine vessels, AIS transmission days ranged between the first (30.5%) and third (48.2%) quartile, with an average of 38.6%.
- V. For longliners these values were significantly higher with the first quartile being 58.3% and the third reaching 92.5% between 2018 and 2021, with the average being 73.6%.

¹ Referring to the mean number of days with no AIS transmission per year, where either the next or previous position was outside of port (see methods for further details).

² Number of days in which a vessel had at least one transmission

- VI. The lowest number of transmission days from a single purse seiner was 34 days (2.3%) and the highest 1,004 days (68.7%). For longliners these values were 33 days (2.3%) and 1,458 days (99.8%).
- VII. The average length of all gaps outside of port peaked for purse seiners in 2020 (195 days) with the other years averaging 162.6 days (155.8, 167.6 and 164.3 respectively to the three other years). For longliners the values remained very similar between 2018 and 2020, averaging 108.3 days (106.5, 100.8 and 107.6 days respectively to the three years) but were with 84.3 days much lower in 2021.
- VIII. The longest gap locations of purse seine vessels aligned with the area of the highest activity, mainly occurring in the eastern Atlantic in proximity to and inside west African coastal EEZs. The total average gap length was less than 5 days for 28 of the 40 vessels (3rd quartile).
- IX. There were 9 purse seiners and 54 longliners with no gaps longer than 28 days and 4 vessels (3 purse seiners and 1 longliner) with gaps exceeding 70 days in each of the four years. The longest gaps between 2018 – 2021 were: 208.8, 210.7, 219 and 101.5 days respectively.
- X. The gaps from Spanish longline vessels proportionally occurred more often in proximity to EEZ boundaries. The total average gap length was less than 2 days for 95 vessels (3rd quartile). However, there were multiple vessels each year with gaps exceeding 100 days (with the longest gaps between 2018 – 2021 were: 286.5, 148, 178.7 and 134.4 days respectively).
- XI. The frequency of gaps was on average higher for longline vessels (11.9 gaps per 1000 AIS transmissions) compared to purse seiners (10.1 gaps per 1000 AIS transmissions). However, this was mainly influenced by a small number of longliners with very high gap frequencies. The median for purse seiners was 6.15 gaps per 1000 AIS transmissions, while the longliners median was 0.44 gaps per 1000 AIS transmissions.
- XII. The AIS positions of the Spanish fishing fleet would suggest that the Gulf of Guinea high-risk area (HRA) was avoided between 2018 and 2019. However, it is highly unlikely that the gaps in transmissions of all vessels were related to the possible piracy risk.

Summary analysis of French-flagged vessels

French-flagged purse seine vessels were operational in the analysis period for a total of 41,661 vessel-days (i.e., 1,461 days per vessel x 27 vessels and three vessels which only transmitted for parts of the analysis period, the 2021 transmissions of the GURE AMETZA II were not included due its flag change). Based on analysis at fleet- and vessel-level, the following points can be considered for French vessels:

- I. The operations of the French purse seine vessels occurred in similar locations to the Spanish fleet, mainly transmitting on the West African coast (incl. EEZs). However, most transmissions were located in the Gulf of Guinea.
- II. The 30 purse seine vessels transmitted on AIS for a total of 25,730 days, which corresponds to 61.7% of the days of the analysis period.
- III. The vessels did not transmit on 15,931 days (38.2%) during the analysis period.
- IV. AIS transmission days ranged between the 43.3% for the first and 75.4% for the third quartile, with an average of 61%.
- V. The lowest number of transmission days was the CAP HORIZON, which transmitted in two months of 2018 and on three days in 2020 to a total of 48 days (4.4%). The number of transmissions from most vessels was significantly higher, with the first quartile being at 640 days (43.7%). The highest number of days with transmissions were 1458 days (99.8%).
- VI. The average length of all gaps outside of port remained very similar between 2018 and 2020, averaging 131.1 days (126.3, 136.7 and 130.3 days respectively to the three years) but were much lower in 2021 (80.3 days).
- VII. The longest gap locations of purse seine vessels aligned with areas with the highest activity, mainly occurring in the Gulf of Guinea. This suggests that the vessels possibly operated in this area during the transmission gaps as well. The total average gap length was less than 2.1 days for 22 vessels (3rd quartile). There were three vessels with gaps exceeding 3-day average gap length but not more than 7 days.
- VIII. Most of the French purse seine vessels can be divided into two groups. There were 10 vessels with no transmission gaps exceeding 10 days and 14 vessels which exceed this gap length every year. Excluding the CAP HORIZON, the longest gaps between 2018 – 2021 were: 132.2, 194.4, 84.2 and 81.9 days respectively.
- IX. The frequency of gaps was on average 5.38 gaps per 1000 AIS transmissions, with the 3rd quartile being 2.25 gaps. This difference was driven by 4 vessels with more than 24 gaps per 1000 AIS transmissions, while most vessels did not exceeded 1 gap per 1000 AIS transmissions.

- X. The gaps from French purse seine vessels proportionally occurred more often in proximity to the east of the Gulf of Guinea between 2018 and 2019. While this could indicate that at least some of the transmission gaps were related to the Gulf of Guinea high-risk area (HRA), it is highly unlikely that this was the explanation for most transmission gaps for all vessels.

Summary analysis of Portuguese-flagged vessels

Portuguese-flagged longline vessels were operational in the analysis for a total of 28,855 vessel-days (i.e., 1,461 days per vessel x 17 vessels and four vessels which only transmitted for parts of the analysis period). Based on analysis at fleet- and vessel-level, the following points can be considered for Portuguese vessels:

- I. Portuguese longliners operated in similar regions as those from Spain. However, their overall range was more limited, especially between 0 – 30 degrees North and the eastern South Atlantic.
- II. The 21 vessels, transmitted on AIS for a total of 22,256 days, which corresponds to 77.1% of the days of the analysis period.
- III. The vessels did not transmit on 6,599 days (22.9%).
- IV. AIS transmission days ranged between 65.2% for the first and 93.7% for the third quartile, with an average of 76%.
- V. The lowest number of transmission days from a single longliner was 320 days (43.8%) and the highest 1449 (99.2%).
- VI. The average length of all gaps outside of port peaked in 2020 (72 days) with the other years averaging 53 days (50.4, 54.4 and 54.1 respectively to the three other years).
- VII. The Portuguese longliners behaved differently to the Spanish ones: their longest gaps were much more evenly distributed through the Atlantic (rather than in proximity to EEZ boundaries) corresponding to the areas where these vessels operated. The total average gap length was less than 0.66 days for 16 vessels (3rd quartile). However, gaps exceeding 28 days also occurred in 11 vessels. The longest gaps between 2018 – 2021 were: 46.9, 48.1, 107.4 and 98.1 days respectively.
- VIII. The frequency of gaps was on average 3.58 gaps per 1000 AIS transmissions, with the 3rd quartile being 3.61 gaps. The difference between these two values is minimal as only three vessels had more than 12 gaps per 1000 AIS transmissions.
- IX. The AIS positions of the Portuguese fishing fleet were not in proximity to the Gulf of Guinea high-risk area (HRA). It is highly unlikely that the gaps in transmissions were related to the possible piracy risk.

Summary analysis of Italian-flagged vessels

There were 11 Italian-flagged purse seine vessels transmitting from the Mediterranean. The maximum transmission rate of these vessels would be 15,706 vessel-days (i.e., 1,461 days per vessel x 10 vessels and one which only transmitted for three years of the analysis period). Based on analysis at fleet- and vessel-level, the following points can be considered for these vessels:

- I. The 11 vessels, transmitted on AIS for a total of 6,231 days, which corresponds to 39.7% of the analysis days.
- II. AIS transmission days ranged between the 22.4% for the first and 65.4% for the third quartile, with an average of 35.8%.
- III. The vessels did not transmit on 9,475 days (61.5%).
- IV. When removing the ANGELA ARCELLA as an outlier (no transmissions in 2020), the average length of all gaps outside of port remained similar throughout the four years, averaging 84.7 days (86.6, 84.7, 87.2 and 80 days respectively).
- V. The low transmission rate is likely related to the vessels entering ports much more frequently than the other vessels in this analysis. The average number of gaps in port was 438, which is nearly three times more than the other purse seiners reviewed in this analysis (154 gaps).
- VI. When removing the Italian-flagged ANGELA ARCELLA as an outlier (average gap length of 255.8 days), the average gap length outside of ports did not exceed 2.3 days for 9 vessels (3rd quartile). All vessels demonstrated gaps exceeding 7 days. The longest gaps between 2018 – 2021 were: 151.8, 143.8, 366 and 119.8 days respectively. Comparing these values to the average demonstrates the discrepancy between the twelve vessels. Due to the nature of the operations of these vessels, it is likely that port calls occurred within these transmission gaps.
- VII. The frequency of gaps per 1000 AIS transmissions ranged between 0.18 to 18.44, with an average of 6.61.

Recommendations

For further investigation access to Vessel Monitoring System (VMS) and logbook data could compliment the analysis on the motivations behind the transmission gaps.

- It would allow verification of the vessel location and possible activities during periods of non-transmission.
- If data cannot be obtained, the relevant West African coastal states should be contacted to ensure that they are aware of the vessels entering their EEZs with AIS turned off.
- A vessel of interest list for each coastal state could support countries in reducing IUU fishing risks.
- An analysis of the recently identified hotspots³ for disabling events in Argentina and the Northwest Pacific could further support a global understanding of AIS transmission and gap patterns.

Further analysis of the gaps larger than one day could provide valuable insights into the motivations behind the transmission gaps. These gaps are generally more likely to be related to ‘dark’ fishing events.

- The analysis should include the overall length of these gaps and their location. Where AIS transmission starts and end points occur away from ports and other such infrastructure, it would be beneficial to review other AIS identities in the vicinity.
- By incorporating other AIS identities, this could allow insights into potential meetings between fishing vessels and support vessels e.g., fish carriers.
- Further investigations could reveal additional information on the reason for periodic, irregular transmission patterns.

³ [Welch et al., 2022](#)

Due to non-transmission on AIS, it is recommended to clarify the legal status of EU-flagged vessels against Article 10 of EU Regulation 1224/2009, and Article 6a and Annex II, part I, of Directive 2002/59/EC⁴. As this is related to the fitting of AIS by fishing vessels and its subsequent maintenance in operation.

- AIS transmission rates should be included in port inspections and stricter enforcement of the regulations could increase compliance with these.
- Reviewing recorded and reported vessel collisions and near-misses in the ICCAT area, and the AIS transmission status of the vessels involved, may be of value in indicating the safety benefits of transmitting on AIS.

The risks associated with transmission gaps also vary between fleets, especially between domestic and offshore vessels.

- Further analysis, dividing vessels by type, size and ownership could provide more insights into the motivations of AIS transmission gaps of the different operators.

Finally, further AIS analysis of individual vessels could highlight the nature of the AIS gaps and the reasons behind them.

⁴ [Regulation 1224/2009](#) and [Directive 2002/59/EC](#)

Introduction

This report summarises the results of Automatic Identification System (AIS) usage from 227 longline and purse seine fishing vessels with lengths exceeding 25 m, with International Commission for the Conservation of Atlantic Tunas (ICCAT) authorisation and operating in the Regional Fisheries Management Organisation (RFMO) area of competence (Figure 1). The vessels were flagged to European Union (EU) countries, including Spain, France, Portugal and Italy. The analysis period was 01Jan2018-31Dec2021.

Automatic Identification System (AIS)

AIS is a maritime collision avoidance system transmitted on marine VHF radio and provides information on position, speed, course and identity data, as inputted by the transmitting vessel. AIS is not tamper-proof, so it can transmit poor, false or incomplete identity data and can be turned-off.

Maritime Mobile Service Identity (MMSI)

A Maritime Mobile Service Identity (MMSI) is a unique nine-digit number that is entered into an AIS transponder and identifies a particular vessel. Each MMSI should be associated with a national ship radio licence. The first three digits of an MMSI are Maritime Identification Digits (MIDs). MIDs denote the administration (country) or geographical area of the administration responsible for the ship station, this identity information is used to as an indicator of the vessel's flag state.

International regulations

According to the International Convention for the Safety of Life at Sea (SOLAS) regulation V/19 all ships of 300 gross tonnage and upwards engaged on international voyages should carry an AIS unit. The regulation requires that AIS shall ‘provide information - including the ship's identity, type, position, course, speed, navigational status and other safety-related information - automatically to appropriately equipped shore stations, other ships and aircraft.’⁵ The EU is signatory of this convention (Article 10 of EU Regulation 1224/2009). They additionally require fishing vessels of 15 meters to transmit on AIS (Article 6a and Annex II, part I, of directive 2002/59/EC and EU commissions directive 2011/15/EU). However, fishing vessels engaging in activities outside of the Exclusive Economic Zone (EEZ) of their flag state often only transmit sporadically. This poses a risk of vessel collision, as the primary purpose of AIS is the avoidance of such events, but also it is a risk indicator that would highlight the potential obscureness of activities. While vessel operators often claim that the lack of transmissions is due to piracy risks, previous reports of the Indian Ocean⁶ have highlighted that EU vessels are frequently not transmitting outside of the high-risk areas (HRA) for piracy.⁷ This report explores this rationale in relation to the Gulf of Guinea HRA and the Atlantic Ocean in general. AIS positions will be presented by the named flag states and gear types.

The data for this work is compiled in a separate document, named *OM23 – 013 ICCAT AIS utilisation table 2018 – 2021*⁸.

⁵ [IMO: Solas Convention](#)

⁶ [Automatic Identification System \(AIS\) usage by Spanish and French-flagged vessels](#)

⁷ [https://www.europarl.europa.eu/RegData/etudes/BRIE/2020/649333/EPRS_BRI\(2020\)649333_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/BRIE/2020/649333/EPRS_BRI(2020)649333_EN.pdf)

⁸ [Download link: OM23 – 013 ICCAT AIS utilisation table 2018 – 2021](#)

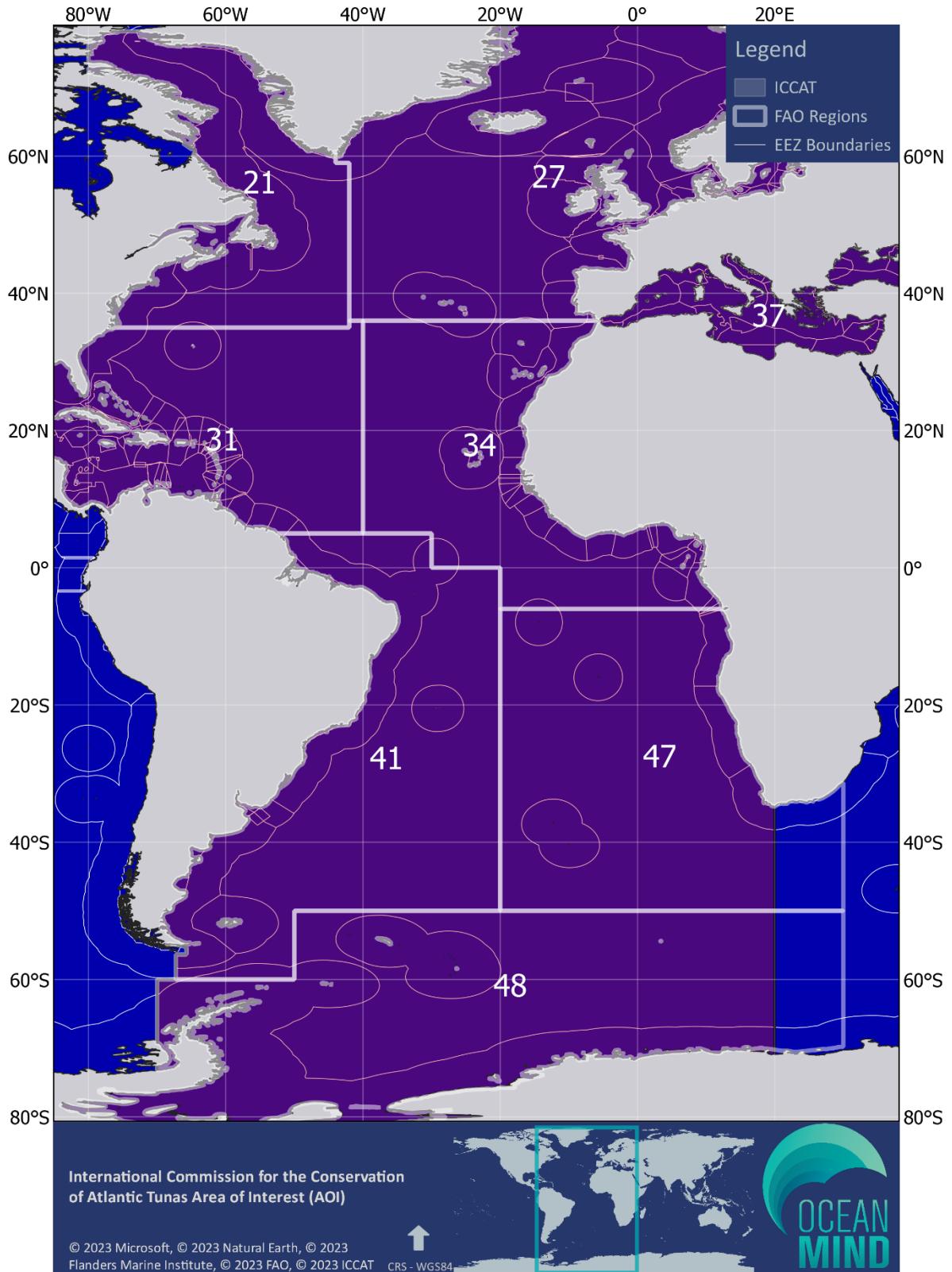


Figure 1 | Map of the AOI, Atlantic Ocean showing Food and Agriculture Organisation (FAO) major fishing areas within the ICCAT area of competence. The FAO regions 47 and 48 extend further to the east than the ICCAT jurisdictive area.

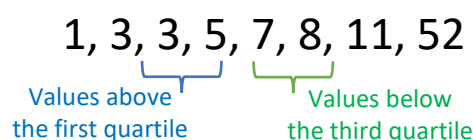
Methodology

This assessment of AIS utilisation was conducted for EU flag-states between 01Jan2018 and 31Dec2021. Longline and purse seine vessels were included if they engaged in any fishing related activity (transits excluded) in the ICCAT area, were authorised by the RFMO and exceeded an overall length of 25 m. Possible fishing activity was determined via pattern recognition. This typically includes a set movement (circle) for purse seine vessels followed by slow speeds and for longline vessels by a linear movement followed by slow speeds (soaking) before repeating the linear movement into the opposite direction (retrieving).

To understand the AIS usage over the 4-years within the ICCAT area, an algorithm calculated the frequency and lengths of transmission gaps. A gap was defined as a period of at least 90 minutes without an AIS transmission. Any day with at least one transmission was counted as a transmission day. Additionally, it determined the longest gap lengths per vessel within a year and the number of days the vessel transmitted. AIS transmission distributions per hour per day and throughout the year were accumulated for daily and seasonal cycles of transmissions (see section AIS Transmissions). Gaps in transmission inside the ports of OceanMind’s database (including all ports where fishing vessels transmit on AIS) were not reported within this analysis, however, these gaps are still reflected in the total number of days of AIS transmissions. For example, if a vessel did not leave a port throughout a year and transmitted every second day, in the analysis it would be considered to transmit 182 days (365 days/2), but the number of gaps would be nil.

The analysed vessels show a large distribution of transmission rates. This makes conventional statistical outputs (e.g., average values, longest gaps, or total range) less meaningful. This is further impacted by the fact that some vessels only transmitted for fractions of the analysis period or changed the MMSI number.

To mitigate this quartile ranges have been used in the analysis. The quartile ranges are the 50% of a data set surrounding the median (the value which separates the higher half from the lower half).



To assess AIS distribution for each flag-state, heatmaps of AIS transmission densities were generated using a 10 NM grid for each year in the period 01Jan2018-31Dec2021.

Limitations

The focus of the analysis was the assessment of AIS transmission gaps and not the analysis of whole vessel tracks. This creates limitations and requires assumptions, including:

1. Transmissions from inside a port were not considered, as there is no certainty that the vessel may have only been docked. However, the exact positions of the docking were not assessed. This means that there is a possibility that a vessel has changed the docking position. This event would not be presented in the number of gaps, as long as the first and last position were inside of port.
2. In some instances vessels did not transmit for more than a year. If these gaps were at the start or end of the analysis period, the vessel was considered to be 'out of service' and the year was removed from the possible maximum days the vessel could have transmitted. If an exact day (e.g., start of operation or end of service) was known, the exact number of days were removed. Additional adjustments had to be made for SIEMPRE AL ALBA, which changed flag state in Jan2020 from France to Spain, and for ANGELA ARCELLA, which transmitted very infrequently compared to other vessels of the Italian fleet.
3. Some AIS transmissions were from anomalous positions, such as a latitude value above 90. There are different reasons for this, such as a bit flipping (i.e., a bit switching its state from 0 to 1 due to vibrations on the vessel), which may not always relate to the vessel. To easily identify these as false positions, they were moved by the algorithm to a location in the Sahara (from which no legitimate transmission would occur). As these were still transmissions from the vessels, they were considered in the gap calculations. However, due to the location they were removed in figures showing the locations of the longest gaps.
4. To determine AIS transmission gaps in this report, OceanMind utilised dynamic AIS⁹ as well as satellite and terrestrial receivers. There is a possibility that these services do not obtain all transmissions from every vessel, but they amount to a standard in which it is highly unlikely that transmissions would be missing to create a 90-minute gap.
5. Vessels in this report were grouped by flag state and gear type, which inevitably generalises vessel activity. As individual vessel transmissions can show variability, the overall statements made of a specific flag state may not reflect the behaviour of each vessel. For example, even if the transmission rate from a flag state may be high, there might still be individual vessels broadcasting very infrequently on AIS.

⁹ [Definition of Dynamic AIS](#)

AIS Transmissions

The AIS transmission rates vary significantly between the 145 longliners and 82 purse seiners but also by flag state for the period 01Jan2018 – 31Dec2021. To develop a good understanding of a vessel's compliance with the EU and SOLAS regulations, a variety of parameters should be considered. The number of gaps and the average length of the gaps can provide a good overview of this compliance. However, these two parameters could still be skewed if the vessel had a small amount of large and small gaps. To account for this, the total number of days a vessel transmitted on AIS should be included. A secondary validation can be achieved by including the number of transmissions in relation to the AIS gaps.

OceanMind conducted an analysis of the number of transmissions per hour, to look at possible transmission pattern throughout the day. However, the results showed no clear pattern. As the fishing grounds of longliners are further offshore, it is possible that any differences in transmission numbers are related to satellite coverage. The number of transmissions for purse seiners were slightly elevated around local noon and before midnight. While it is possible that this is related to crew resting times, the pattern was not clear enough to show this with a high analytical confidence.

Purse seine fishing vessels

The two EU flag states with ICCAT authorised fishing vessels operating in the Atlantic are Spain and France. Italy contribute with 11 vessels, which exclusively operated in the Mediterranean. While the other two flag states operate in similar regions, their transmission activity varies significantly. While the days on AIS range from 600 to 1,100 for the first and third quartile for France, this range is 400 to 730 for Spain (Figure 2). The average gap length for French vessels is much shorter as well, with the 3rd quartile being at 2.2 days compared to the Spanish 4.6 days.

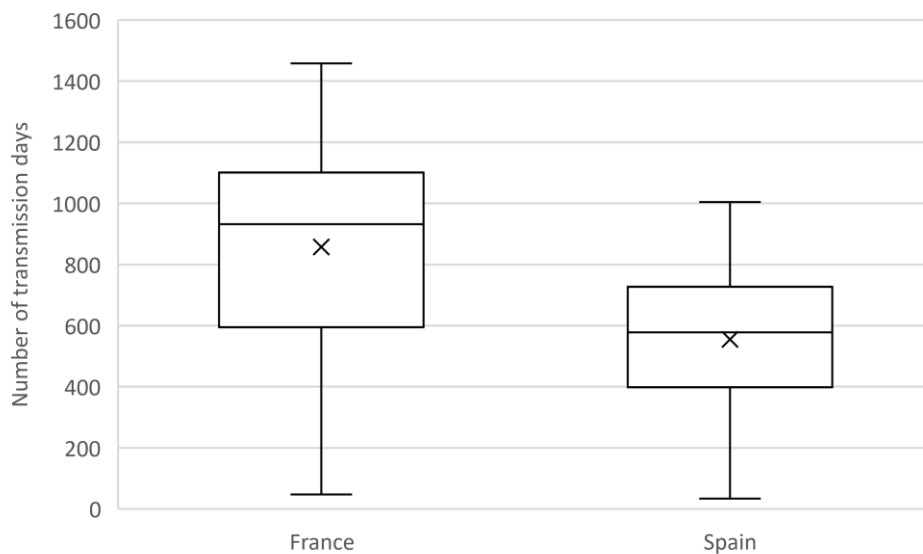


Figure 2 | Boxplot diagram of transmissions days from French and Spanish purse seine fishing vessels. The lower end of the box represents the first quartile and the upper part of the box the third quartile. The X represents the average value.

The purse seine fishing vessels transmitted less frequently than the longliners. This was especially pronounced for transmissions outside of port (Figure 3) and, above all, the vessels flagged to EU-Spain demonstrated low transmission rates when they was more than 12 NM offshore. When vessels did transmit, it was mainly in upwelling regions in proximity to or inside West African EEZs and it is likely that vessels carried on with their activities in the neighbouring locations while remaining 'dark' (not transmitting).

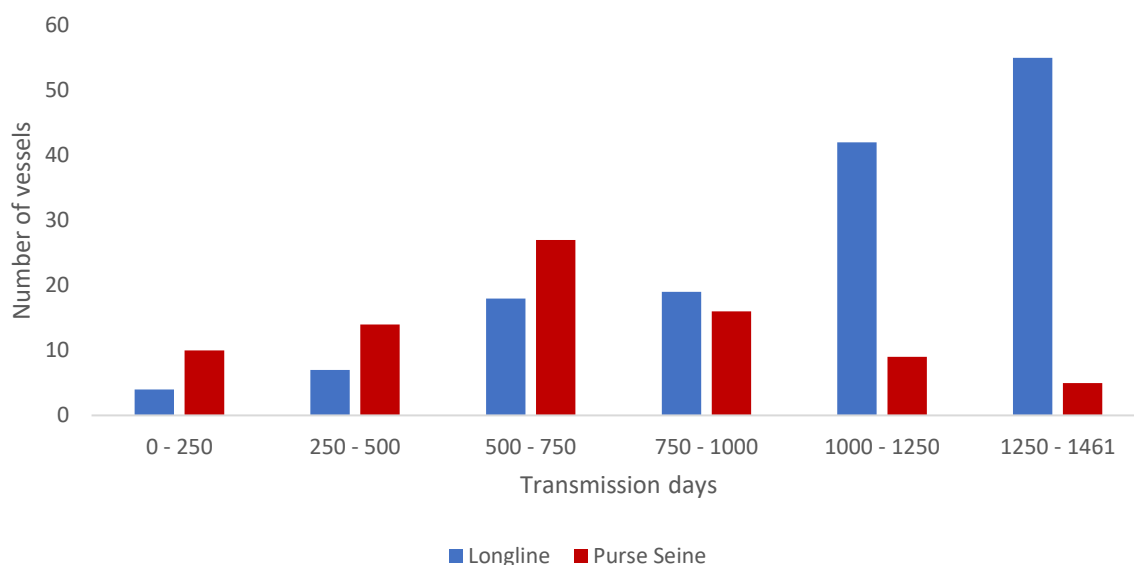


Figure 3 | Number of transmission days of longliners and purse seiners which transmitted with the same MMSI for the whole analysis period.

The number of vessels transmitting was slightly higher between June and August (Figure 4). This coincided with the peak fishing season in Italy and off the African west coast. On average, less than half (37.3) of the 82 included purse seine vessels transmitted on AIS on any given day of the analysis period. The highest number (68) of vessels transmitted on 03Jun2019 and there were only 18 days where more than 60 vessels transmitted. The lowest number was 11 vessels transmitting daily, which occurred multiple times between December and January.

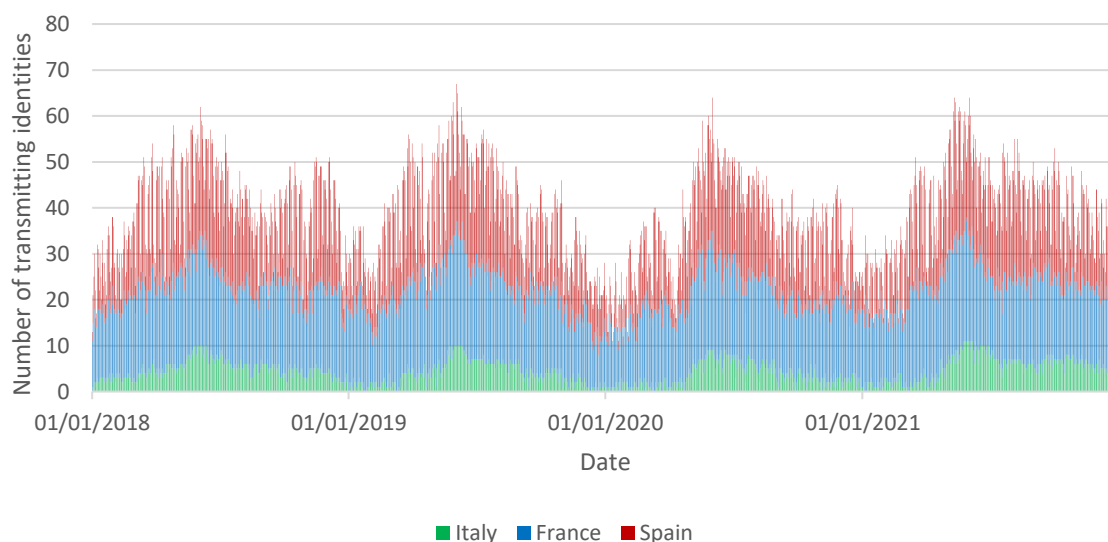


Figure 4 | Histogram representation of all purse seine vessels in the Atlantic transmitting on AIS for the period between 2018 – 2021.

Longline fishing vessels

Longline fishing vessels in this analysis were flagged to Spain (124) and Portugal (21). While they operated in most of the high seas areas of the Atlantic, gaps in transmissions occurred disproportionately often in proximity to EEZ boundaries (i.e., it is likely that the transmission gaps were a result of tampering with the unit). The transmission rates of the Portuguese and Spanish vessels were very similar. For both flag states the average gap length was below 2 days, with AIS days ranging from more than 800 to 1,350 days between the first and third quartile. While the Spanish gaps were marginally longer, this was likely a result from a few outliers.

In general, the transmission rate of the analysed longline fishing vessels was higher than for purse seine vessels. On any given day, an average of 73.4% of the longline vessels transmitted on AIS. However, with the highest value being 122 transmitting vessels, there were at least 33 (15.9%) vessels not transmitting on any given day of the analysis period. Throughout the analysis period, the number of transmitting longliners decreased to a quarter between Christmas and New Year (Figure 5). There is no clear pattern which would indicate fishing season or an impact of the Covid-19 pandemic. The only exception may be the low number of transmitting vessels (71 identities) between 27 – 29Apr2020. However, it is unclear if the pandemic was the reason for this incident or if it is a data artifact.

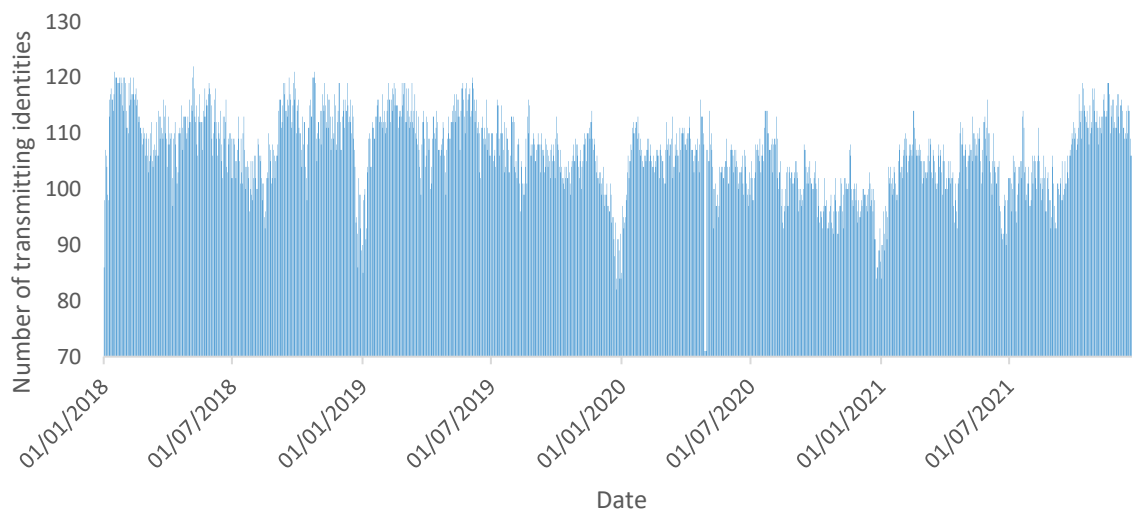


Figure 5 | Histogram representation of all longline vessels in the Atlantic transmitting on AIS for the period between 2018 – 2021.

Flag-state transmission on AIS

EU-Spain

The Spanish fishing fleet comprised 63.4% of all analysed vessels, including the highest number of both purse seine (40)¹⁰ and longline fishing (124) vessels. On average, purse seine vessels transmitted on less than half of the analysis period (552 days), where longliners transmitted on nearly twice this number (1,074 days).

Spanish purse seine vessels

The average number of AIS transmissions more than doubled between 2018 (20,832 transmissions) and 2021 (53,278 transmissions). While the overall transmissions increased, the AIS transmissions south of the equator and on the high seas decreased through the years (Figure 6). Most of the activity centred between Mauritania and the Ivory Coast (including), FAO region 34.

Some of the smaller vessels operated between the north of Spain, Ireland and the Azores (FAO region 27). Vessels fishing close to the Azores EEZ only occasionally entered with slow speeds. Even though the Azores are part of EU waters, this could indicate a possible risk of unauthorised fishing in the area.

Most of the longest gaps occurred in the EEZs of West African countries mentioned above and for the smaller vessels in Spain, starting and ending after and before port calls (Figure 7 | A visualisation of the longest three AIS transmission gaps of the purse seine vessels from Spain.). This pattern is similar to the behaviour of Spanish fleets operating in the IOTC RFMO region¹¹. While the total number of transmissions increased every year, the average overall gap length outside of port remained at a similar level (155.8 – 167.5 days), with the only increase occurring in 2020 (195 days of), likely due to the periods of inactivity during the covid-19 pandemic. It is therefore likely that the increase in transmissions was a result of better AIS coverage (e.g., more satellites) and not related to the behaviour of the vessels (Figure 8).

¹⁰ The GURE AMETZA II reflagged to France and is listed in this sub-section, as the AIS transmission of 2018 and 2019 are considered here

¹¹ [OM22 – 219 AIS USAGE BY FLAG-STATES IN THE INDIAN OCEAN](#)

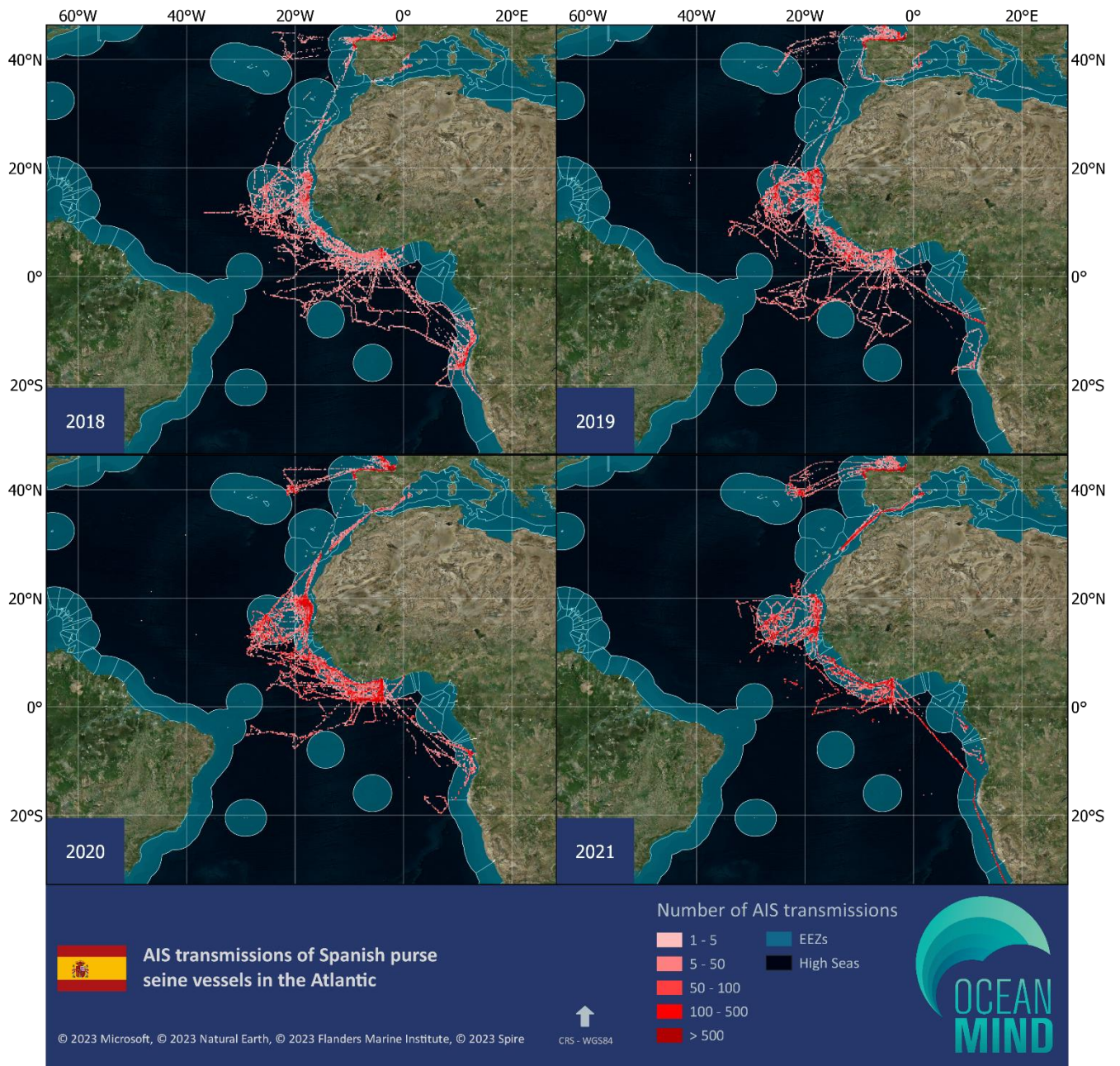


Figure 6 | Heatmap of all AIS transmission of the Spanish purse seine vessels in the Atlantic Ocean which were considered in this analysis

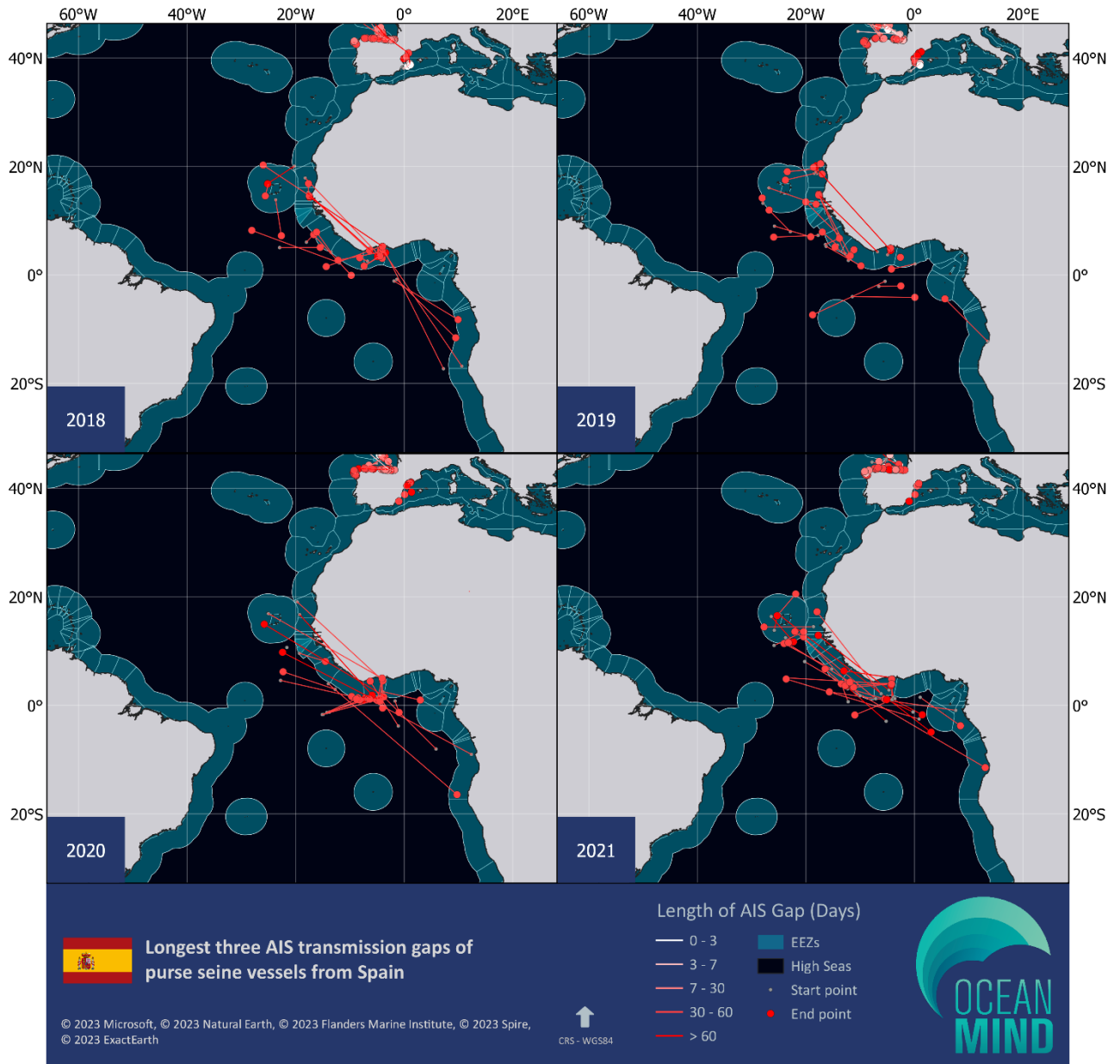


Figure 7 | A visualisation of the longest three AIS transmission gaps of the purse seine vessels from Spain. The colour of the end point aligns with the line – meaning a white dot represents 0 – 3 days, where a red dot represents more than 60 days

While at-sea, the Spanish purse seine vessels demonstrated the largest AIS gaps of all the EU vessels considered in the analysis. Due to the location and length, it is likely that the gaps occurred for the duration of the fishing trip, which is common for purse seiners. These vessels were not following the SOLAS and EU regulation on AIS, and the lack of transmissions could have enabled ‘dark’ fishing activity in areas where the vessel may not have had authorisation.

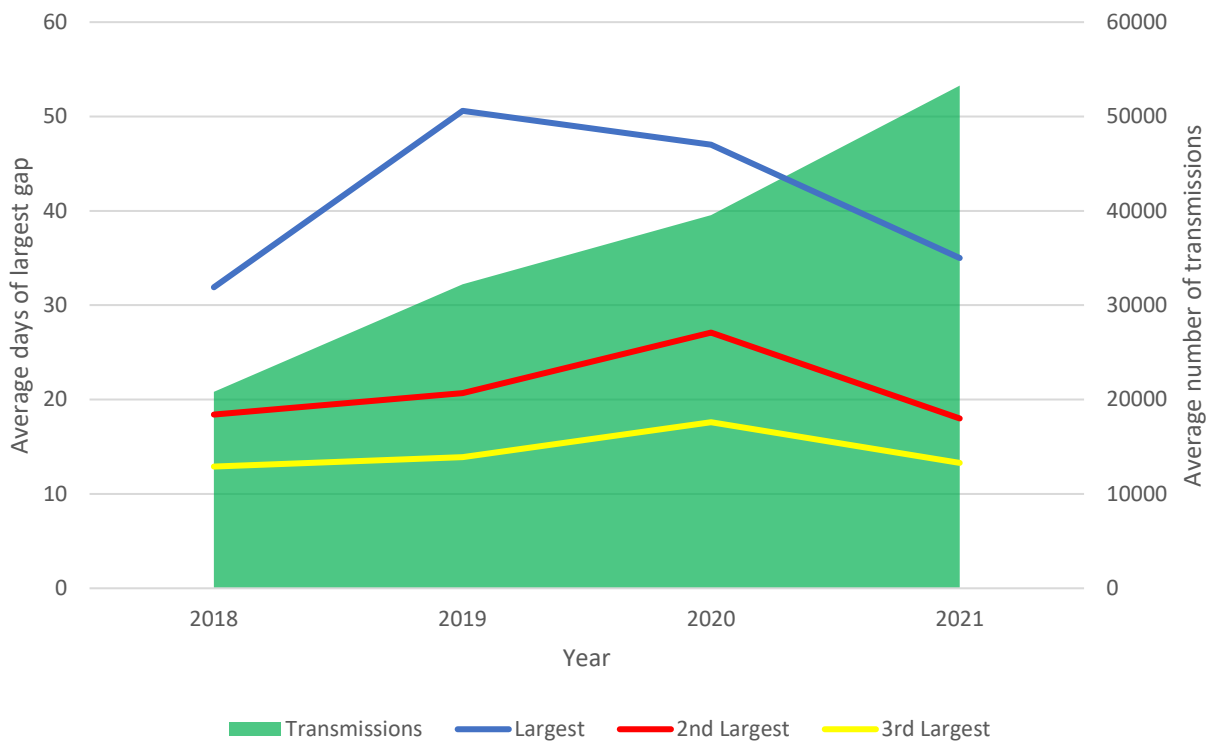


Figure 8 | Average length of the largest three gaps and the number of transmissions of Spanish purse seine fishing vessels between 2018 and 2021.

Spanish longline vessels

Spanish longliners mainly operated in European EEZs and the high seas. The only exception appears to be the Mauritania and Sao Tome and Principe EEZ. Transmissions from other EEZs were likely related to transits. Highly trafficked ports outside of the EU appear to be in Cape Verde (Mindelo), Namibia (Walvisbay) and Uruguay (Montevideo). Fishing activity mainly occurred north of 30 degrees North and south of 20 degrees South, with some activity between the latter and Cape Verde. Activity in the Gulf of Guinea increased over time, while operations in the west Atlantic (FAO Region 31) only occurred in 2018 and 2019 (Figure 9). Further analysis would be required to detail the activity inside these EEZs.

Most of the longest gaps of Spanish longline fishing vessels occurred in proximity to EEZs boundaries. This poses a risk of vessel incursions and engaging in unauthorised activity while not transmitting (Figure 10).

The average number of transmissions increased even faster than for the purse seiners (Figure 11). The faster increase is likely a result of a higher reporting rate and transmission collection (i.e., technical advancement of AIS units resulting in higher ping rates or better satellite cover), as the total length of gaps outside of port remained on a similar level between 2018 and 2020 (on average 106.5, 110.8 and 107.6 days respectively), before it dropped in 2021 (84.3 days). Furthermore, as for the purse seiners, there is no clear indication that the number of gaps correlated with the transmission increase. The longest gaps occurred in 2020, which may have been related to the covid-19 pandemic.

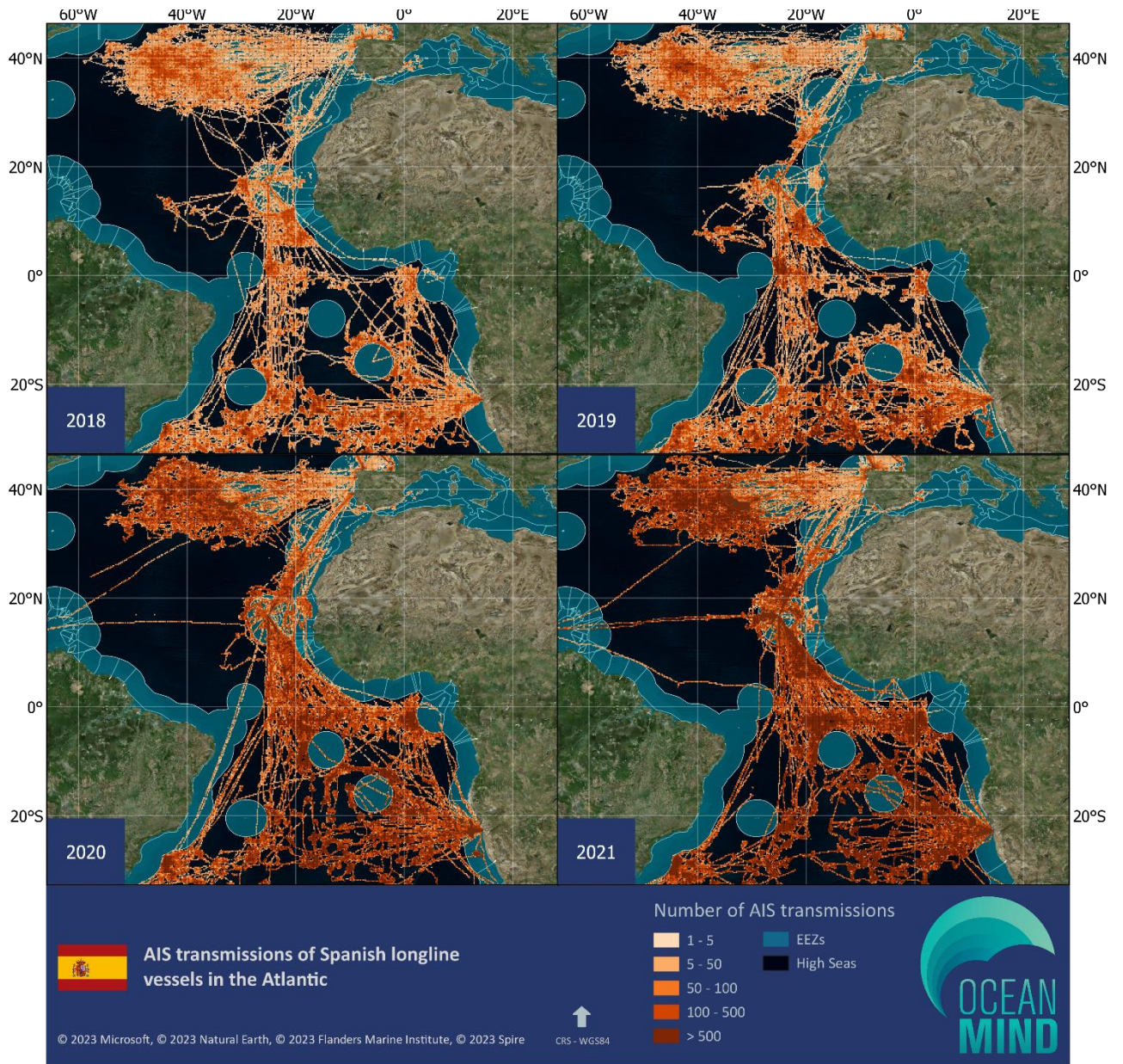


Figure 9 | Heatmap of all AIS transmissions of the Spanish longline vessels in the Atlantic Ocean which were considered in this analysis

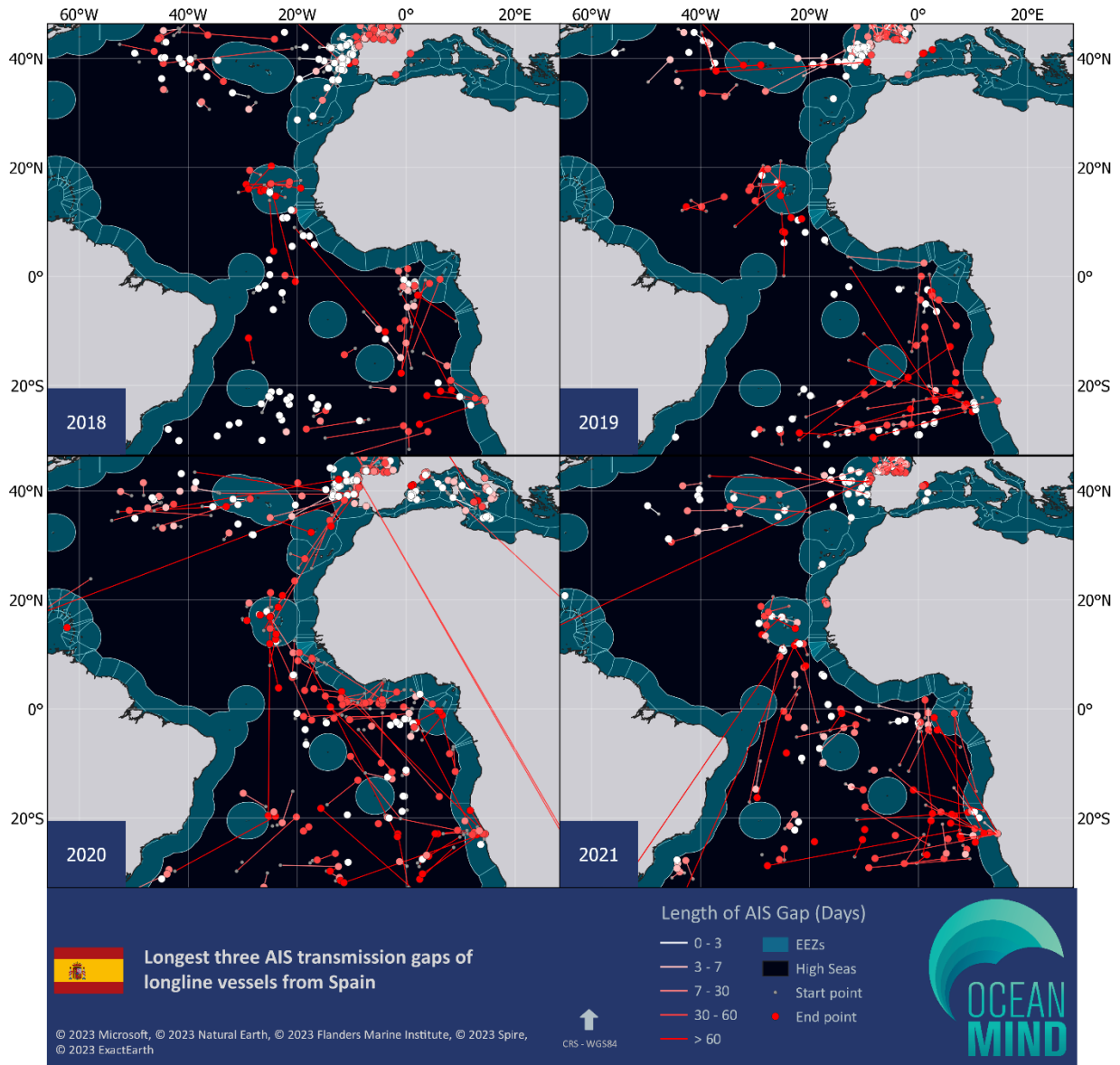


Figure 10 | A visualisation of the longest three AIS transmission gaps of each longline vessel from Spain. The colour of the end point aligns with the line – meaning a white dot represents 0 – 3 days, where a red dot represents more than 60 days

While Spanish longline fishing vessels transmitted more often than purse seiners during their fishing trips, the transmission gaps still appear to have been intentional. They proportionally occurred more often in proximity to EEZ boundaries. Therefore, the risks with regards to the AIS SOLAS and EU regulation, and unauthorised ‘dark’ fishing activity are applicable to most of the Spanish fleet.

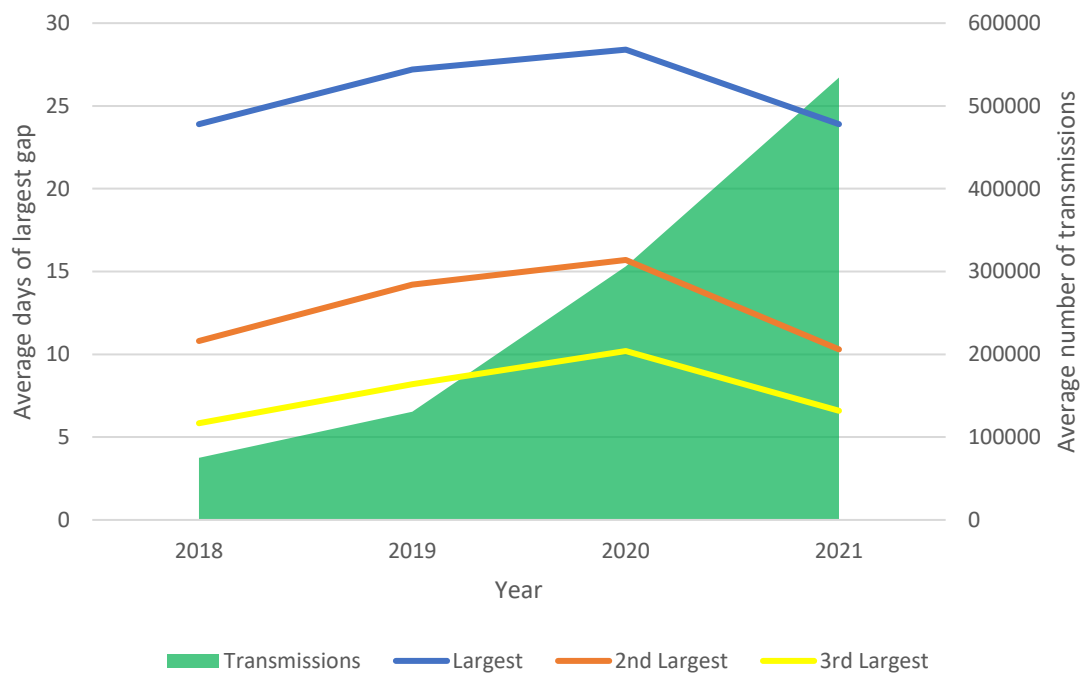


Figure 11 | Average length of the largest three gaps and the number of transmissions of Spanish longline fishing vessels between 2018 and 2021.

EU-France

The French ICCAT authorised fishing fleet included 30 (36.6%) of the 82 purse seine vessels in the analysis. The fleet comprised of large-scale vessels operating in the Atlantic and smaller scale vessels in the Mediterranean. The vessels transmitted on average for 844.7 days, which is significantly higher than their Spanish counterparts. However, this also means that the vessels did not transmit on average for 616.4 days and 22 (71%) vessels did not transmit for more than a quarter of the four-year analysis period.

The average number of AIS transmissions more than tripled between 2018 (38,403 transmissions) and 2021 (115,779 transmissions). While the overall transmissions increased, the AIS transmission days remained on a similar level throughout all years. The activity concentrated in the Mediterranean and between Mauritania and Angola (including), FAO region 34 and 47 (Figure 12). Compared to the Spanish purse seine fleet, the activity mainly occurred on more southern latitudes. The vessels also demonstrated more activity in the high seas. However, this may be a result of the French vessels transmitting more of their fishing trips compared to the Spanish purse seiners.

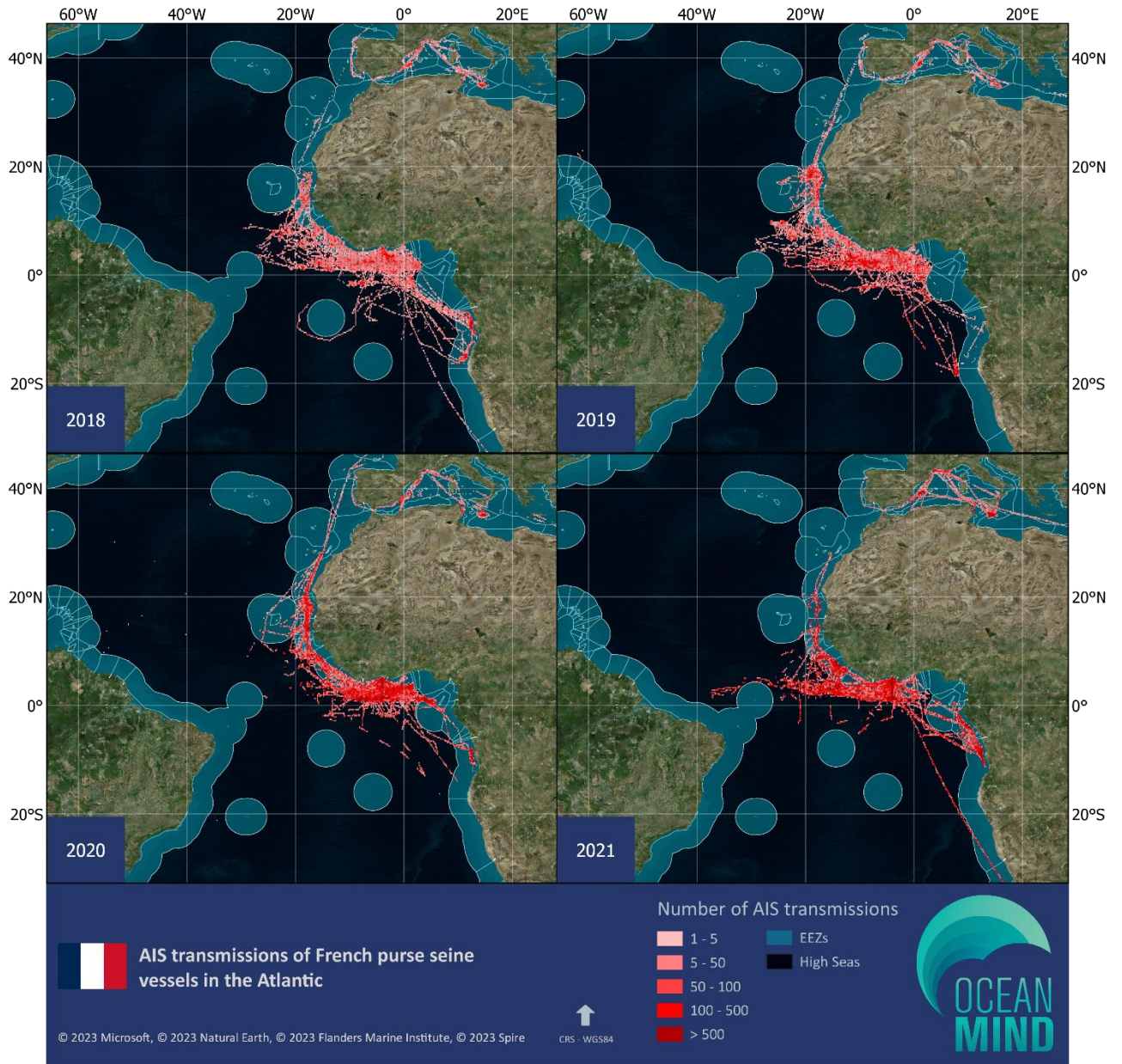


Figure 12 | Heatmap of all AIS transmission of the French purse seine vessels in the Atlantic Ocean considered in this analysis. The colour of the end point aligns with the line – meaning a white dot represents 0 – 3 days, where a red dot represents more than 60 days

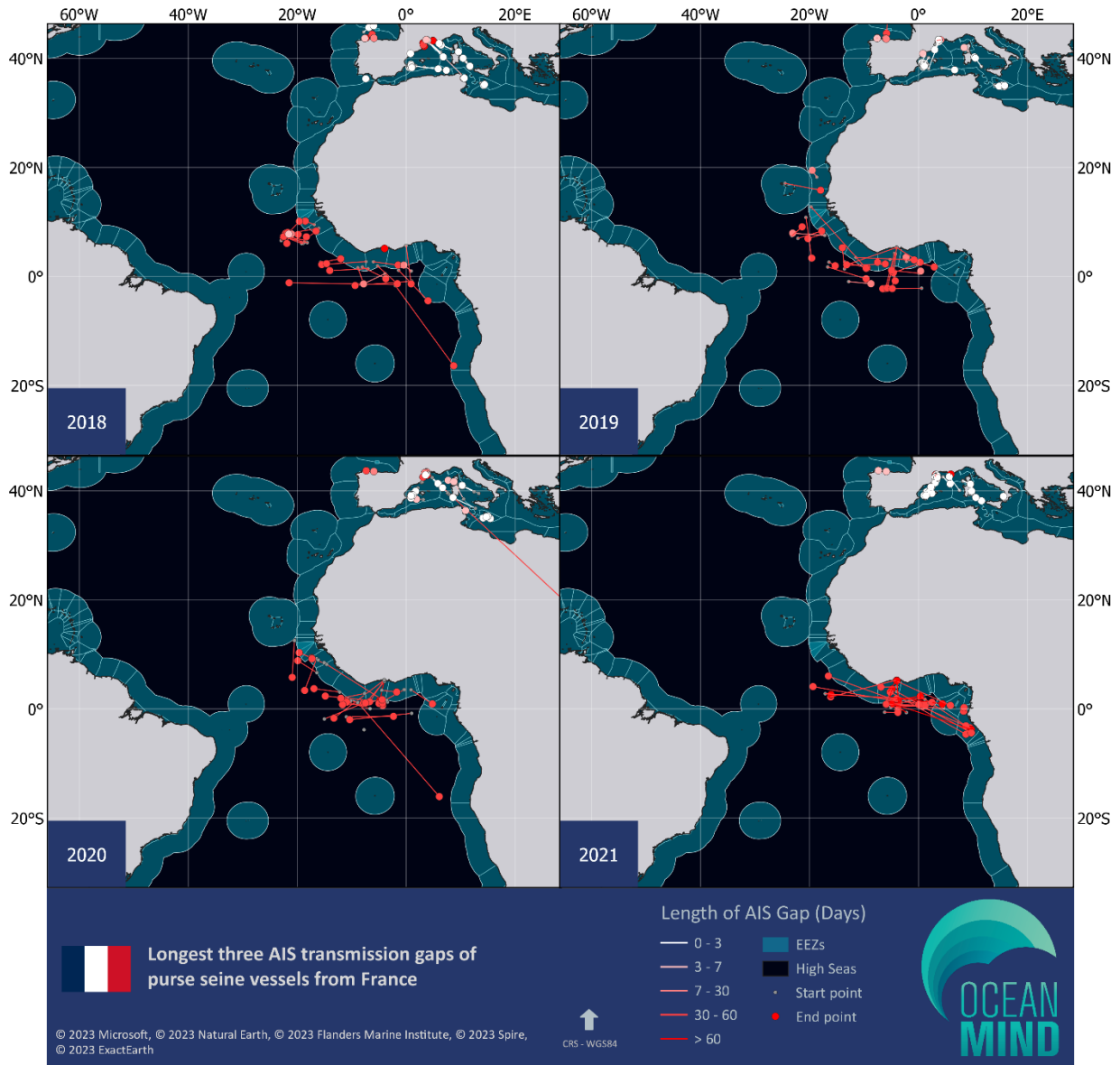


Figure 13 | A visualisation of the largest three AIS transmission gaps of the purse seine vessels from France. The colour of the end point aligns with the line – meaning a white dot represents 0 – 3 days, where a red dot represents more than 60 days

Due to the length of the longest gaps, it is very likely that entire fishing trips were conducted without transmitting on AIS for any of the sets. This would also align with the location of the gaps, which mainly occur either before or after transits to and from ports (Figure 13). Therefore, the risks of ‘dark’ fishing in French purse seiners is more dependent on the individual vessel behaviour, compared to the Spanish purse seiners. There was a considerable risk of collisions when these vessels transited to and from port. The average length of the longest gap decreased between 2019 and 2021. However, vessels with gap lengths consistent with fishing trips (10 to 30 days), had these gap durations through all four years. Some vessels even have more than three gaps in this range (longer than 10 days) in individual years. Hence, the increase of the second and third longest gaps (Figure 14). Conclusively, there are more days when French Purse Seiners transmitted compared to their Spanish counterparts, but the overall number of transmission days was still low, posing a significant collision risk, and compromising the safety of the vessels crews and violating the SOLAS and EU regulation. There is also a considerable risk of ‘dark’ fishing and associated unauthorised activity.

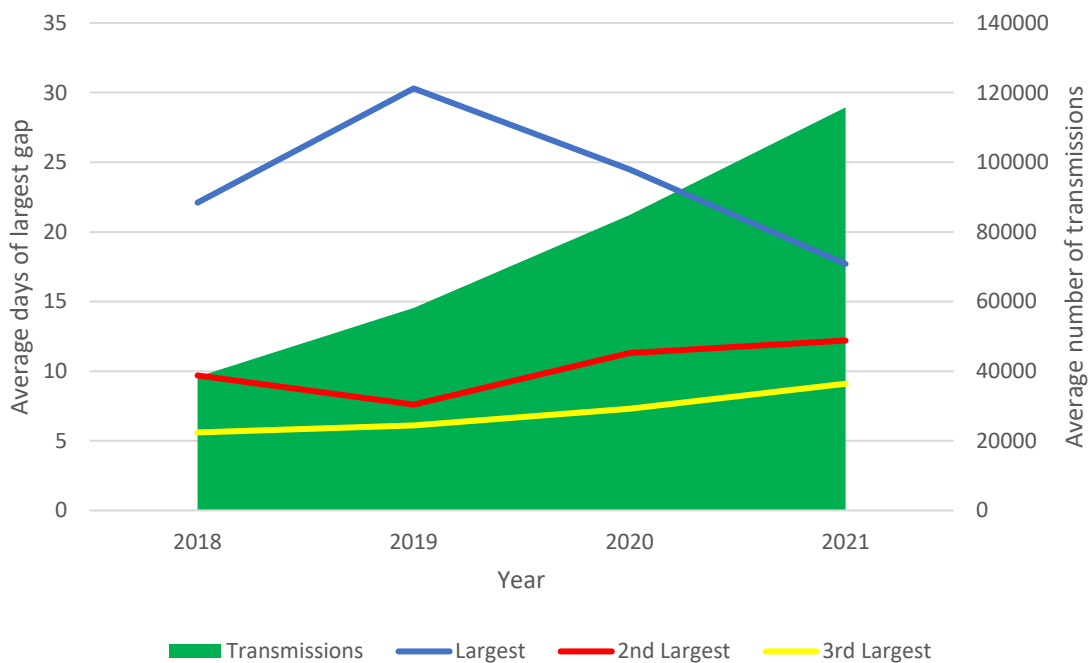


Figure 14 | Average length of the largest three gaps and the number of transmissions of French purse seine fishing vessels between 2018 and 2021.

EU-Portugal

The Portuguese ICCAT authorised fishing fleet comprised 21 (9.3%) longline fishing vessels above 25 m. With an average of 1,059 days, transmission rates were very similar to Spanish longliners. Operations also focused on the parts of the Atlantic north of 30 degrees North, the high seas of the Gulf of Guinea and to the south of 20 degrees South (FAO Regions 21,27, 34,41 and 47). While EEZ boundaries were mostly avoided between 2018 and 2019, there was some activity in Namibia and Sao Tome and Principe EEZ (Figure 15). However, further analysis would be required to determine the activity of the vessels inside these EEZs.

The longest gaps of Portuguese longline fishing vessels occurred more in proportion to the AIS activity, compared to the Spanish equivalents. This means the more AIS positions were transmitted in a location, the higher the likelihood of a gap occurring there. However, there was also an over representation close to west African EEZs. As highlighted before, this poses a risk of vessels engaging in unauthorised activity while not transmitting (Figure 16).

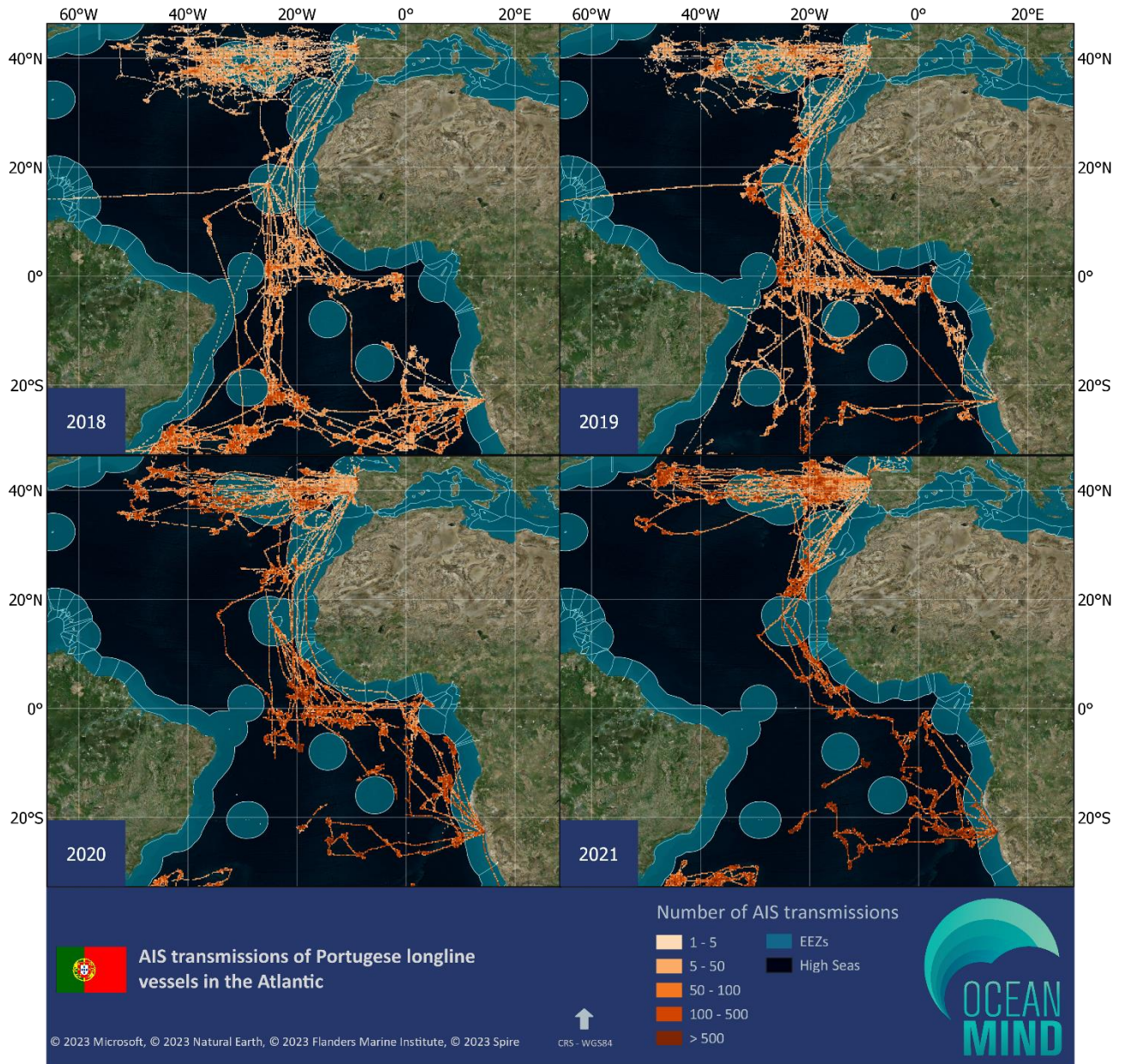


Figure 15 | Heatmap of all AIS transmission of the Portuguese longline vessels in the Atlantic Ocean considered in this analysis.

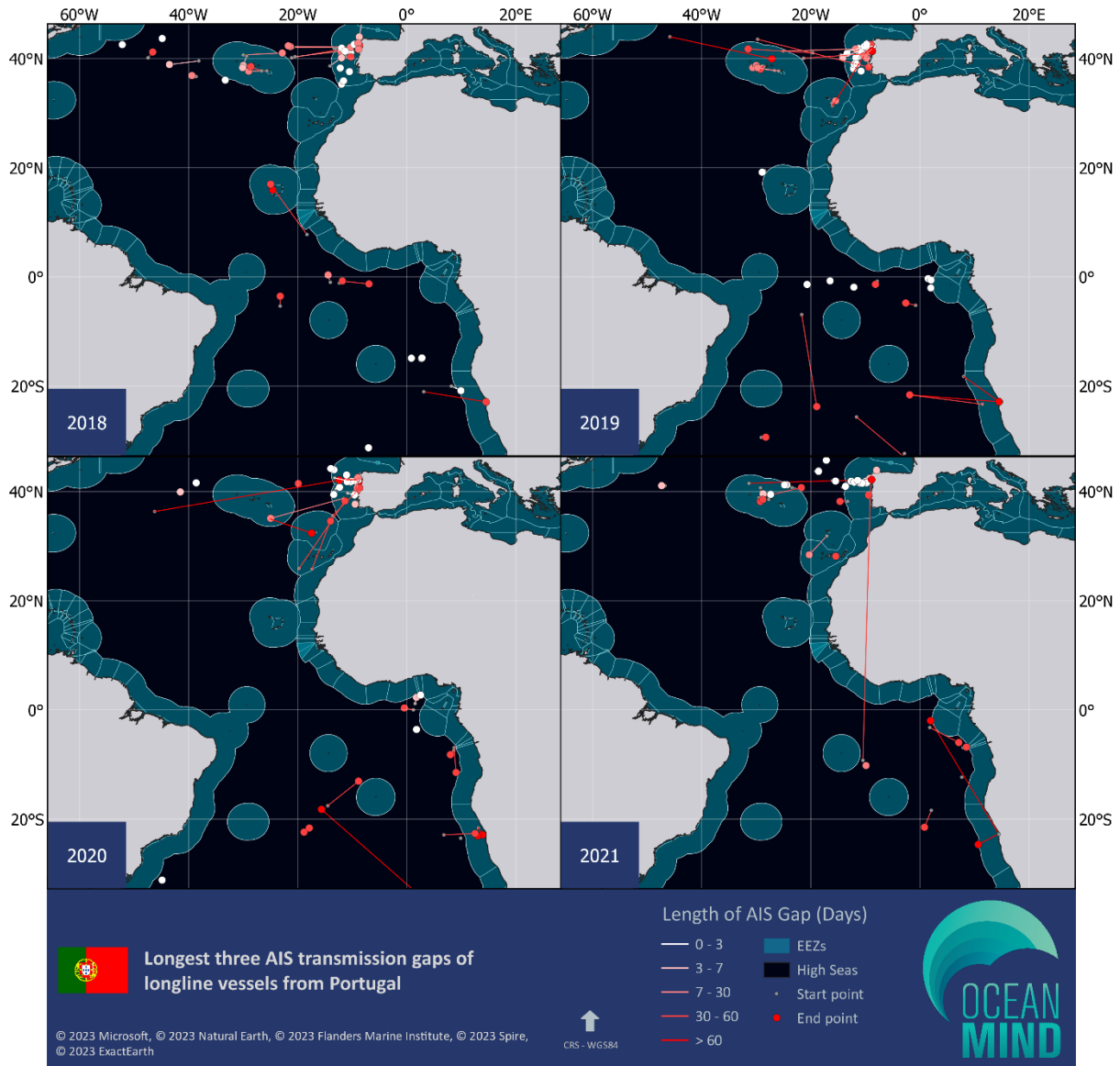


Figure 16 | A visualisation of the largest three AIS transmission gaps of the longline vessels from Portugal. The colour of the end point aligns with the line – meaning a white dot represents 0 – 3 days, where a red dot represents more than 60 days

Except for the largest gap in 2021, the average length of the three longest gaps per vessel demonstrated an increasing trend (Figure 17). The number of gaps had decreased from 215 to 101 between 2018 and 2021. The total number days of gaps for Portuguese longliners was similar for 2018 (67.6) and 2021 (65.3) but significantly higher in 2019 (88.5) and 2020 (92.8). It is possible that this increase was related to the covid-19 pandemic.

Most Portuguese longliners demonstrated gaps outside of port which exceeded at least one week. As these gaps were also not in proximity to the HRA for piracy, it is highly likely that the lack of transmission is not related to this threat. The vessels therefore did not comply with the EU and SOLAS regulations and pose a significant risk of engaging in ‘dark’ activities possibly unauthorised.

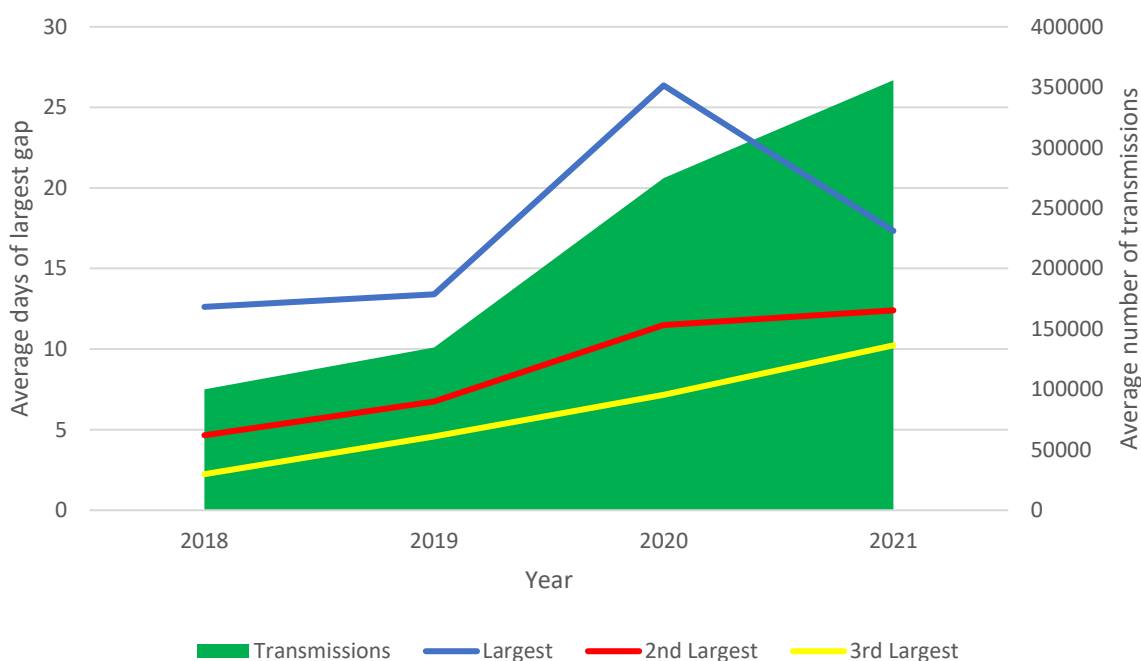


Figure 17 | Average length of the largest three gaps and the number of transmissions of Portuguese longline fishing vessels between 2018 and 2021.

EU-Italy

The analysis included 11 Italian purse seiners, 13.4% of the total 82 vessels. All of those exclusively operated inside the Italian EEZ, except for one vessel operating in the Spanish EEZ in 2021 (Figure 18). The vessels transmitted on average for 566.5 days, with only three vessels transmitting for more than half of the analysis period.

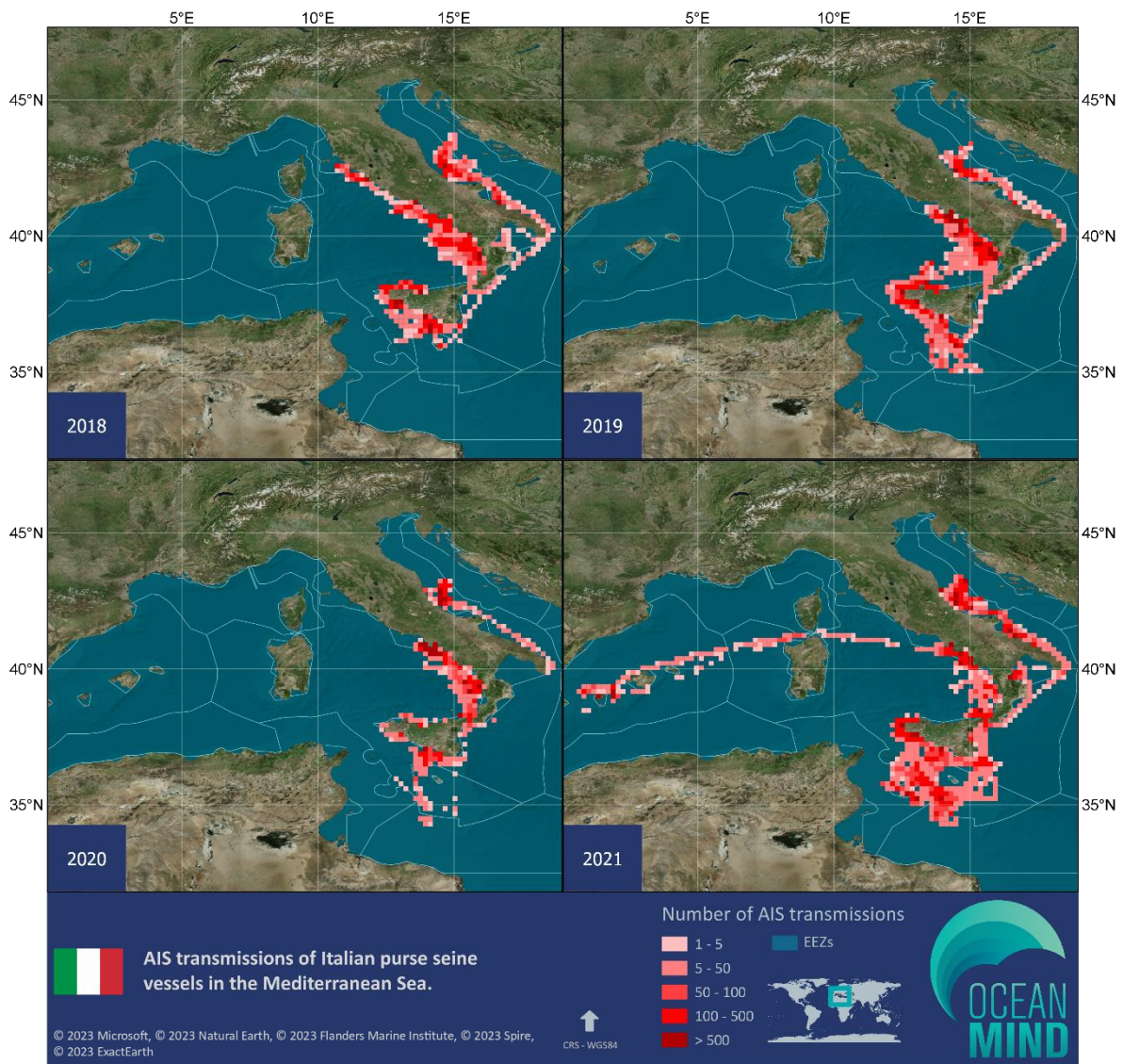


Figure 18 | Heatmap of all AIS transmission of the Italian purse seine vessels in the Mediterranean considered in this analysis.

As almost all the transmissions coming from inside Italian EEZ, the longest gaps were also located here. Furthermore, some of the longest gaps were much longer than the expected length of a fishing trip of these vessels. It is therefore likely that the longest gaps include some port calls. Due to the long gaps, these vessels were the only ones in the analysis where the number of transmissions did not increase (Figure 19). Like the longest gaps, the number of AIS transmissions and gap days also fluctuated and showed no clear pattern. This may be because the smaller vessels are more impacted by seasonality and annual stock fluctuations in their waters. Another explanation may be related to the gaps not following a clear pattern (e.g., fishing trips) and therefore are more impacted by other, more randomised, events. This does highlight a challenge in marine management and the requirement to utilise VMS data to assess the activity of these vessels. Especially as these vessels operated close to shore where they encounter a larger density of vessels, and the collision risk was elevated. To mitigate this, these vessels should follow the SOLAS and EU regulations.

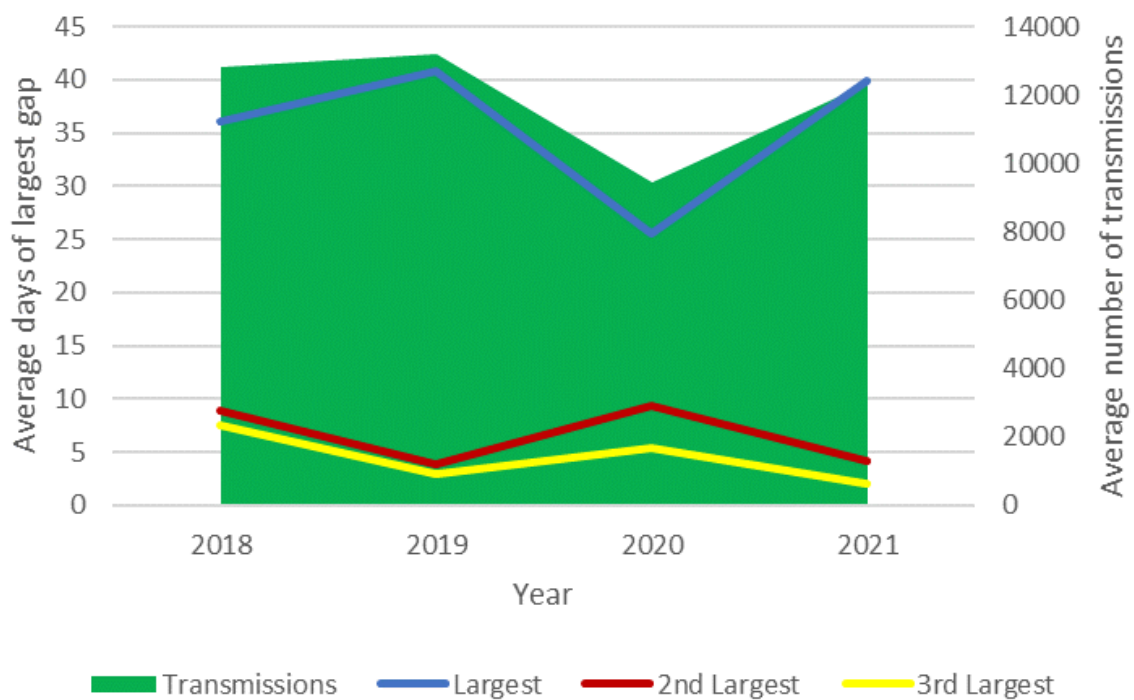


Figure 19 | Average length of the largest three gaps and the number of transmissions of 10 Italian flagged purse seine fishing vessels between 2018 and 2021. The ANGELA ARCELLA was removed in this figure, as it was considered an outlier in the analysis (average gap length of 255.8 days).

Conclusions

All EU flagged and ICCAT authorised vessels demonstrated some level of possible non-compliance with the EU commissions directive 2011/15/EU and SOLAS convention. Only four French Purse Seiners, five Portuguese and five Spanish longline fishing vessels demonstrated no days without transmissions outside of port. While it is possible that some of the vessels experienced an AIS outage (e.g., due to unit failure), it is highly unlikely that this was the reason for most of the gaps. This was especially pronounced in some fleets, where there was a consistent pattern of vessels stopping their transmissions at EEZ boundaries. As these were related to either port calls or operations in proximity to an EEZ, the vessels demonstrated an elevated risk to their crew safety (increased collision risk) and of engaging in unauthorised activities (e.g., unauthorised fishing activities or transnational organised crimes). Furthermore, if AIS outages were the reason for the gaps, there should not be a significant difference between gear types and flag states, which is very pronounced in this analysis. Thus, some vessel activities related to non-transmission on AIS by EU-fleets conflict with Article 10 of EU Regulation 1224/2009, and Article 6a and Annex II, part I, of Directive 2002/59/EC.

ICCAT authorised longline fishing vessels above 25 m were exclusively flagged to Portugal and Spain. While these fleets demonstrated comparable transmission rates and fishing areas, the gaps of the Spanish vessels were more often in proximity to EEZ boundaries compared to the Portuguese counterparts. However, it should be noted that the Portuguese fleet was much smaller, which may have resulted in this pattern of behaviour being less pronounced. French and Spanish purse seine vessels also allowed a good comparison between flag states. Both fleets consist of large industrial vessels operating in West Africa and smaller domestic vessels, operating inside European EEZs. While both fleets transmitted insufficiently, the Spanish fleet transmitted significantly less than any other. This may be because the vessels frequently stopped transmitting after leaving ports. This behaviour aligns with the findings of these fleets in the Indian Ocean¹².

¹² [OM22 – 219 AIS USAGE BY FLAG-STATES IN THE INDIAN OCEAN](#)

Other ICCAT authorised EU flagged vessels (including those below 25 m) mainly operated inside their flag-state EEZ or neighbouring EU countries. These vessels demonstrated large gaps which sometimes extended over time periods much longer than individual fishing trips. Further analysis of individual vessels could explore the nature of the AIS gaps and create a stronger case to support the findings of this work.

By contacting the flag-states and highlighting specific transmission gaps in proximity to EEZ boundaries, local authorities could investigate the compliance of these vessels through their VMS data. The reported outcome of non-compliance with EU commissions directive 2011/15/EU and SOLAS convention is of concern and should be addressed.