IOTC CATCH-EFFORT ASSESSMENT, AND AIS USAGE BY FLAG-STATES IN THE WESTERN INDIAN OCEAN, 2016-2020

Area of interest (AOI)	Western Indian Ocean
Analysis Period	01Jan2016 – 31Dec2020
Data Sources	IOTC catch and effort data, Spire AIS data
Submitted to	Blue Marine Foundation
Date Submitted	17th November 2022
Report Number	22-150
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Abbreviations

AIS	Automatic Identification System	JPN	Japan (flag-state)
AOI	Area of Interest	KOR	South Korea (flag-state)
CHN	P.R. China (flag-state)	LKA	Sri Lanka (flag-state)
DAYS	Number of Days (Fishing)	MUS	Mauritius (flag-state)
EEZ	Exclusive Economic Zone	MYS	Malaysia (flag-state)
EUESP	EU-Spain (flag-state)	SETS	Number of Sets
EUFRA	EU-France (flag-state)	SYC	Seychelles (flag-state)
EUITA	EU-Italy (flag-state)	THA	Thailand (flag-state)
FDAYS	Number of Fishing days	TRIPS	Number of Trips
FHOURS	Number of Fishing Hours	TWN	Taiwan (flag-state)
HOURS	Number of Hours at Sea	UKOT	United Kingdom Overseas Territory
HRA	High Risk Area	VMS	Vessel Management System
IOTC	Indian Ocean Tuna Commission	ZAF	South Africa (flag-state)

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1 Executive Summary

This report summarises the results of geospatial mapping of the fishing effort from surface gears and other gears (Chagos Archipelago only) as published by the IOTC for the period 2016-2020. This analysis focused on the areas and periods of fishing operations of flag-states operating within the Western Indian Ocean, together with AIS usage and transmission relative to the High Risk Area (HRA) for piracy. The key rationale behind the presented analysis are concerns as raised by the Blue Marine Foundation, and others, regarding reported catch-effort, areas of operation, and transparency/visibility of fishing operations in the western Indian Ocean.

Catch and effort data was extracted from available datasets in the Indian Ocean and converted into georeferenced 1°x1° and 5°x5° data grid cells. Data cells were grouped relative to cell position within Exclusive Economic Zones (EEZs) for coastal-states and a disputed maritime territory. Annual effort and catch is reported in table form for each coastal-state, along with months per annum where catch and effort were reported.

- The flag-state EU-Spain reported catch effort in grid cells within coastal-state EEZs, along EEZ boundaries, and on the high seas. There was an overall northwards shift in catch-effort reported by EU-Spain in the western Indian Ocean. There was also a decrease in the number of EEZs within which catch-effort was reported from 2016 (7 coastal-states) to 2020 (4 coastal-states), suggesting a decreased dependence upon access agreements, or else engaging in unregulated access. However, it is considered unlikely that an access agreement was granted for fishing within the Chagos Archipelago EEZ, EU-Spain having reported effort within the Chagos Archipelago EEZ in 2017 and 2019. As offshore licences were not issued by Somalia prior to 2019, the catch effort reported by EU-Spain in 2017 and 2018 within the Somalia EEZ was unlikely to be under an access agreement.
- The flag-state EU-France reported catch effort in grid cells within coastal-state EEZs, along EEZ boundaries, and on the high seas. There was a decrease in the number of EEZs within which EU-France catch-effort was reported from 2016 (7 coastal-states) to 2020 (2 coastal-states), peaking at 10 coastal-states in 2018, suggesting a decreased dependence upon access agreements, or else engaging in unregulated access. Of particular note, EU-France reported effort within the Chagos Archipelago EEZ in 2017 and 2018, despite it being considered unlikely that an access agreement was in place for fishing activity within the Chagos Archipelago EEZ in this period. Additionally, offshore licences were not issued by Somalia prior to 2019, and so the effort reported by EU-France in 2017 and 2018 within the Somalia EEZ was unlikely to be under an access agreement.

- No catch-effort was available for the EU-Italy surface gear fleet operating in the western Indian Ocean for the period 2016-2020, the most recent catch-effort available for this fleet through IOTC being in 2015.
- Mauritius (as a flag-state) reported catch-effort from within the EEZs of similar coastal-states throughout the period 2016-2020, with reporting of catch-effort in the EEZ in all years. Mauritius also reported catch-effort in the Somalia, Tanzania and Yemen EEZs, and on the high seas. As offshore licences were not issued by Somalia prior to 2019, the effort reported by Mauritius in 2017 within the Somalia EEZ was unlikely to be under an access agreement.
- The flag-state Seychelles reported catch effort in grid cells within coastal-state EEZs, along EEZ boundaries, and on the high seas. There was an increase in the number of EEZs within which Seychelles catch-effort was reported from 2016 (8 coastal-states) to 2019 (11 coastal-states), suggesting an increased reliance upon access agreements, or else engaging in unregulated access (although catch-effort was only reported in 6 coastal-state areas in 2020). Of particular note, Seychelles reported catch-effort within the Chagos Archipelago EEZ in 2017 and 2018, despite it being considered unlikely that an access agreement was in place for fishing activity within the Chagos Archipelago EEZ in this period.

Analysis of AIS transmissions by the flag-states EUESP, EUFRA, EUITA, MUS and SYC indicated activity by surface gear fishing vessels across the western Indian Ocean over the period 2019-2020. However, comparisons of AIS transmission with reported areas of catch-effort (for 2019) suggest that significant fishing activity has been undertaken by these flag-states without associated use of AIS. Consequently, in the absences of access to VMS and logbooks, the temporal and spatial nature of all catch areas cannot be confirmed. This may be of particular concern to coastal-states in the AOI, where catch-effort has been declared in grid cells along the boundary of their EEZs.

The International Convention for the Safety of Life at Sea (SOLAS) establishes that (Regulation 19 of SOLAS Chapter V) AIS must be fitted aboard all ships of 300 gross tonnage and upwards engaged on international voyages, all cargo ships of 500 gross tonnage and upwards regardless of where they operate and all passenger vessels. Analysis indicates that although all 5 flag-states have transmission gaps on AIS, there is considerable variation between fleets in use of AIS, with the lowest average use being in the EUESP purse seine fleet, these vessels only transmitting on 26.5% of days of the 731-days between 01Jan2019 and 31Dec2020. Conversely, purse seiners in the MUS fleet transmitted on AIS on an average of 42.2% of the 731-day analysis period. Several individual vessels were selected for additional analysis, with multiple transmission gaps being observed, and with transmission start and end points frequently being during transit to/from port, with low AIS usage in high seas areas and along the boundaries of coastal-state EEZs. The location of these start/end transmissions do not

appear to be significantly associated with the High Risk Area (HRA) for piracy, with AIS transmissions being low both within and a considerable distance from the HRA. For EU fleets, this low usage of AIS by fishing vessels may be of concern under Article 10 of EU Regulation 1224/2009, and Article 6a and Annex II, part I, of Directive 2002/59/EC.

Catch-effort for multiple gears in grid cells associated with the Chagos Archipelago EEZ was spatially and temporally analysed, and for the purposes of reporting is divided into Purse seine, Longline, and Other gears.

- Catch-effort was reported by purse seiners of 6 flag-states in grid cells within, or along the boundary of, the Chagos Archipelago EEZ for the period 2016-2020. Although catch-effort was reported predominantly from boundary cells, analysis indicated surface gear effort may have been present inside the Chagos Archipelago EEZ in 2017 and 2018, by the flag states EUESP, EUFRA and SYC.
- Longline catch-effort data was available at 5°x5° and 1°x1° resolution around the Chagos Archipelago EEZ. The fleets LKA, MYS and TWN reported longline catch-effort in grid cells with significant overlap of the Chagos Archipelago EEZ in the period 2016-2020.
- Three (3) flag-states reported fishing effort with gears other than purse seine and longline within and around the Chagos Archipelago EEZ in the period 2016-2020. Both UKOT and MDV reported catch-effort within the Chagos Archipelago EEZ during the analysis period, with UKOT reporting considerable handline fishing effort in the period 2017-2020. It is unclear whether this effort is a valid representation of fishing effort using handlines in the Chagos Archipelago EEZ by UKOT.

1.1 Key recommendations

- It is recommended that coastal-states review fisheries access agreements for the period 2016-2020 against reported catch and effort by flag-states inside coastal-state EEZs.
- Where access agreements between coastal-states and flag-states were absent for the period 2016-2020, it is recommended that coastal-states request to the flag-states the identity of the vessels that reported these activities (either inside the EEZ or over the boundaries), VMS data, as well as copies of logbooks.
- It is recommended for further investigation of an apparent low rate of AIS transmission by the several flag-states. Where possible, and where there is access to VMS data and logbook data of the vessels concerned, it is recommended that these data be analysed to indicate vessel location during periods of non-transmission on AIS.

- It is recommended that clarification be sought regarding incidences of high effort being reported by flag-states, with low or zero corresponding total catch.
- It is recommended to seek clarification of the method for recording fishing effort in the Chagos Archipelago EEZ as reported by the UKOT flag-state, due to the very high annual effort apparent in the data.

2 Introduction

This report summarises the results of geospatial analysis of fishing effort from surface gears (all gears for Chagos Archipelago only), published by the IOTC for the period 2016-2020. This analysis focused on the areas and periods of fishing operations of flag-states operating within the Western Indian Ocean, together with AIS usage and transmission relative to the High Risk Area (HRA) for piracy. Funding for the presented analysis was provided by the Blue Marine Foundation, with analysis being performed by OceanMind. The key rationales behind the presented analysis are concerns as raised by the Blue Marine Foundation, and others, regarding reported catch-effort, areas of operation, and transparency/visibility of fishing operations in the western Indian Ocean Area of Interest (AOI).

2.1 Area of Interest (AOI)

The AOI was the Western Indian Ocean (FAO Major Fishing Area 51), within the IOTC area of competence. This AOI included EEZs of coastal-states (Figure 1), within which surface gear catch-effort had been reported during the period 2016-2020. To allow for full analysis of reported catch-effort along the eastern boundary of the Maldives EEZ, the AOI was extended beyond the existing IOTC area of competence, standardising the easternmost limit to 80°E (thus removing the previous change to 77°E at 0°N). The EEZs of three coastal states (India, France, South Africa) were pared to include only the area of EEZ within the AOI. The EEZ of Sri Lanka was not included in analysis as most of the Sri Lanka EEZ lay outside of the AOI.

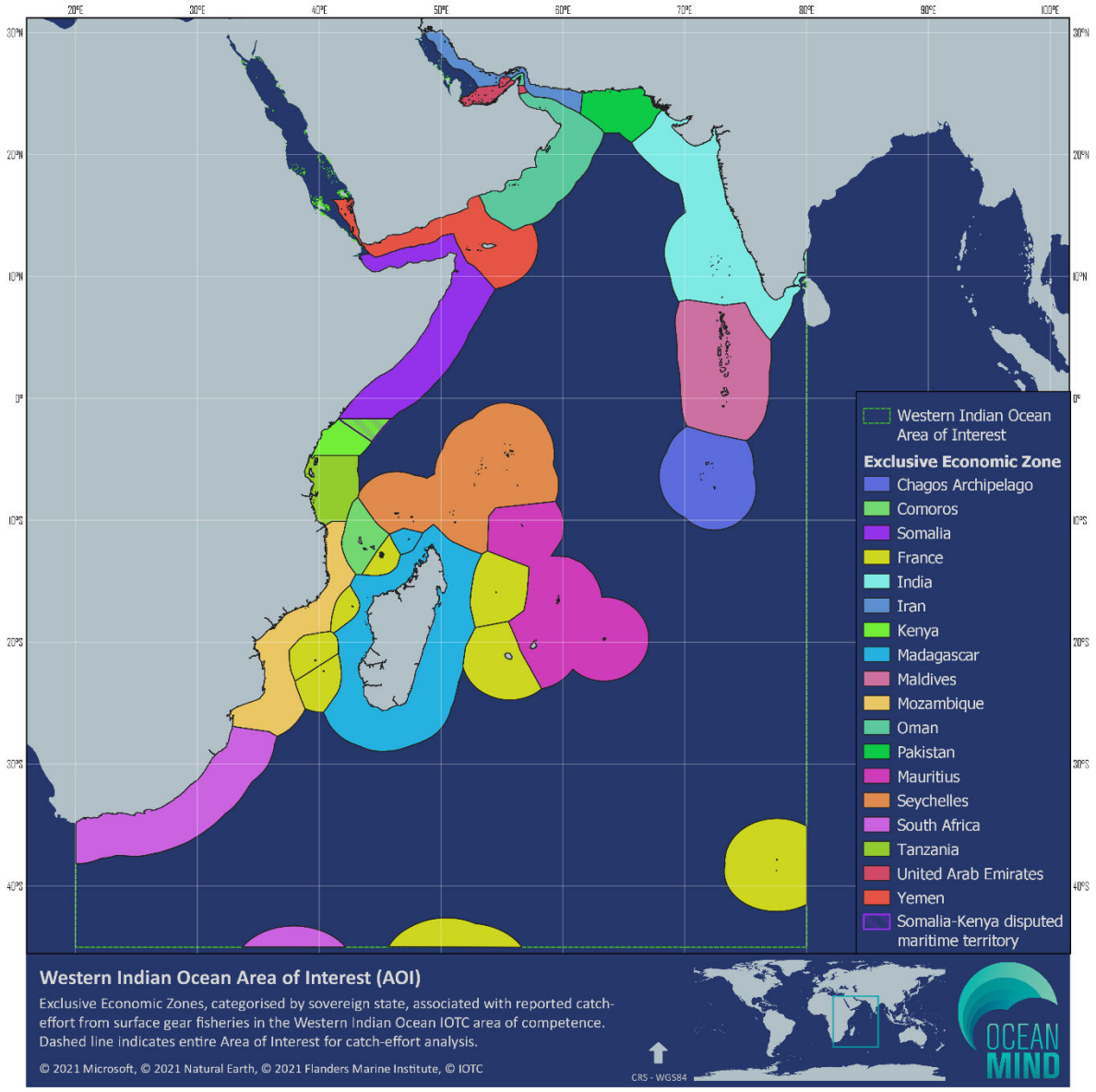


Figure 1: Map of the Western Indian Ocean and coastal-state Exclusive Economic Zones.

3 Methodology

3.1 IOTC Catch-effort data

Catch-effort data is published online by IOTC, categorised by major gear type; Surface Gears, Longline and Other. In the Western Indian Ocean AOI, the only surface gear of relevance was purse seine. Catch-effort data from longline and other gear were only analysed for the grid cells within and around the Chagos Archipelago EEZ, thus the Chagos Archipelago (as a coastal-state) is reported separately from other coastal-states in the AOI.

For the presented analysis, catch-effort data included catch of all IOTC species, including tropical tunas, billfish and relevant shark species. IOTC catch and effort data is made available publicly in a grid system format (see Appendix 1), the spatial information for the catch and effort data is split across major geographic quadrants divided by the Equator (latitude 0°) and the Greenwich parallel (longitude 0°). In order to map the geographical position of catch and effort, 1°x1° and 5°x5° grid cells were extrapolated from the corner of the square closest to 0° latitude and 0° longitude, for each latitude (two digits) and longitude (three digits) included in the IOTC grid format. This was performed using custom code in the software R. The geographic distribution of fishing effort and catch was plotted in the software QGIS.

To differentiate the likelihood of fishing effort and catch occurring within the EEZ of coastal states, data cells were classified into two cell groups, based on geographic characteristics:

> **EEZ cells** were categorised as being effort cells which were situated entirely within the boundaries of an individual coastal state EEZ.
>
> **EEZ-boundary cells** were categorised when any part of an individual cell area spanned an EEZ boundary, either with an adjacent coastal state EEZ or with the high seas. Where cells were shared between coastal-state EEZs, the catch-effort is reported for both (or all) relevant coastal-states.

Catch-effort for cells within the EEZ, or along the EEZ boundary, of coastal states in the western Indian Ocean is displayed spatially in figures and temporally in tables, tables being presented in the format as shown in Appendix 2 (for purse seine catch-effort).

Purse seine gear

Purse seine catch-effort data was extracted from the available surface gears dataset in the Indian Ocean published at https://www.iotc.org/data/datasets/latest/CESurface.

Although generally IOTC publishes catch-effort data from surface gears at 1°x1° degree resolution (grid code prefix "5"), there are occasional exceptions where data is only available at lower resolution, such as 5°x5° degree (grid code prefix "6"). Within the analysis AOI for the period 2016-2019, only two flag states reported catch-effort data for surface gears in 5°x5° degree resolution, these being Sri Lanka and South Africa.

Purse seine catch-effort reported by the flag-states MDV and LKA in the AOI were not included in analysis results, due to them not being distant-water fleets in their areas of operation.

Longline gear

Longliner catch-effort data was extracted from the available dataset in the Indian Ocean published at https://www.iotc.org/data/datasets/latest/CELongline. Relative to surface gears, there was considerably more variability in data resolution in longline catch-effort, from 1°x1° to 5°x10° grid cells. However, for the specific area within which longline catch-effort analysis was required (in and around the Chagos Archipelago EEZ), longline catch-effort data were only available at 5°x5° resolution (grid code prefix "6").

Other gears

Catch-effort data from Other gears was extracted from the available dataset in the Indian Ocean published at https://www.iotc.org/data/datasets/latest/CEOther. There was considerable variability in data resolution in Other gears catch-effort, representing several gear types such as coastal longline, handline and gillnet. For the specific area within which longline catch-effort analysis was required (in and around the Chagos Archipelago EEZ), Other gears catch-effort data were available at 5°x5° and 1°x1° resolution, with the flag state UKOT transitioning from the lower resolution grid cell format to higher resolution over the analysis period.

3.2 AIS transmissions (purse seine vessels)

AIS transmissions were restricted to the western Indian Ocean AOI in the process of creating transmission heatmaps for 5 flag-states, these being EU-Spain (EUESP), EU-France (EUFRA), EU-Italy (EUITA), Mauritius (MUS) and Seychelles (SYC). Heatmaps were generated using Kernal Density Estimation and presented in a single plot per flag-state, using AIS transmissions for the period

01Jan2019-31Dec2020. In addition, a heatmap for AIS transmissions from purse seine support vessels (as authorized by IOTC) within the AOI is also presented.

To compare vessel locations transmitted by vessels of each flag-state against reported location of catch-effort, total annual gridded catch (MT) is presented for purse seine vessels for the flag states EUESP, EUFRA, EUITA, MUS and SYC. The total number of AIS transmissions per flag-state within each 1°x1° grid cell was then calculated, this being plotted on a logarithmic scale and overlaid on the gridded catch weight. To filter out AIS transmissions for purse seine vessels in transit, only AIS transmissions at speeds of <5 knots were included, this vessel speed range being considered to likely be associated with potential fishing activity. Only combined AIS transmissions and catch-effort for 2019 is presented, as 2020 catch-effort data had not been published by IOTC at the time of analysis.

Analysis of gaps in AIS transmission is presented for all vessels for the flag state EUESP, EUFRA, EUITA, MUS and SYC that operated in the western Indian Ocean AOI in 2019 and 2020. Duration of gaps in AIS transmissions for purse seine vessels is presented, as is the number of days with AIS transmission, including as a percentage of the total number of days in the monitoring period (731[1]). For the purposes of the presented analysis, an AIS transmission gap was considered to be a gap of at least 24 hours. To indicate vessel transmission behaviour within and outside port, transmissions outside of the ports of Victoria (Seychelles), Antsiranana (Madagascar), Durban (South Africa) and Port Louis (Mauritius) are presented.

[1] This total was adjusted for ATERPE ALAI (513 days) due to a 07Aug2019 entry into the IOTC area, and BELOUVE (713 days) due to it reflagging on 19th January 2019

4 Temporal and Spatial Analysis (Purse Seine)

Geospatial and temporal distribution of foreign-flagged vessel fishing effort with, and adjacent to coastal-state jurisdiction is reported by coastal state. Purse seine catch-effort associated with the Chagos Archipelago EEZ is presented in a separate section of this report (6.1).

4.1 Union of the Comoros

Catch-effort was reported by 5 flag-states in grid cells within, or along the boundary of, the Comoros EEZ for the period 2016-2020 (Figures 2-3). Catch-effort was reported by the fleets EUESP (2016-2020), EUFRA (2016-2020), KOR (2016), MUS (2016, 2018) and SYC (2016-2020). Catch-effort from surface gears was reported both from boundary cells and inside the Comoros EEZ for the EUESP, EUFRA and SYC fleets during the period 2016-2020. However, only SYC reported catch-effort within the Comoros EEZ in every year from 2016-2020 (principally in January-June), with EUESP and EUFRA only reporting catch-effort within the EEZ in 2016 (Table 1). The flag-states KOR and MUS only reported catch-effort in the Comoros EEZ boundary cells in 2016-2018, with no declaration of catch-effort within EEZ grid cells by these fleets over the analysis period (Table 1).

When interpreting the reported catch-effort along the Comoros EEZ boundary, it is important to consider that the entirety of the Comoros EEZ is contiguous with other coastal-states. Consequently, any catch-effort reported in these boundary cells for the analysis period 2016-2020 must have occurred within the jurisdiction of one or more coastal-states and thus require access agreements(s), or else were the result of unregulated access.

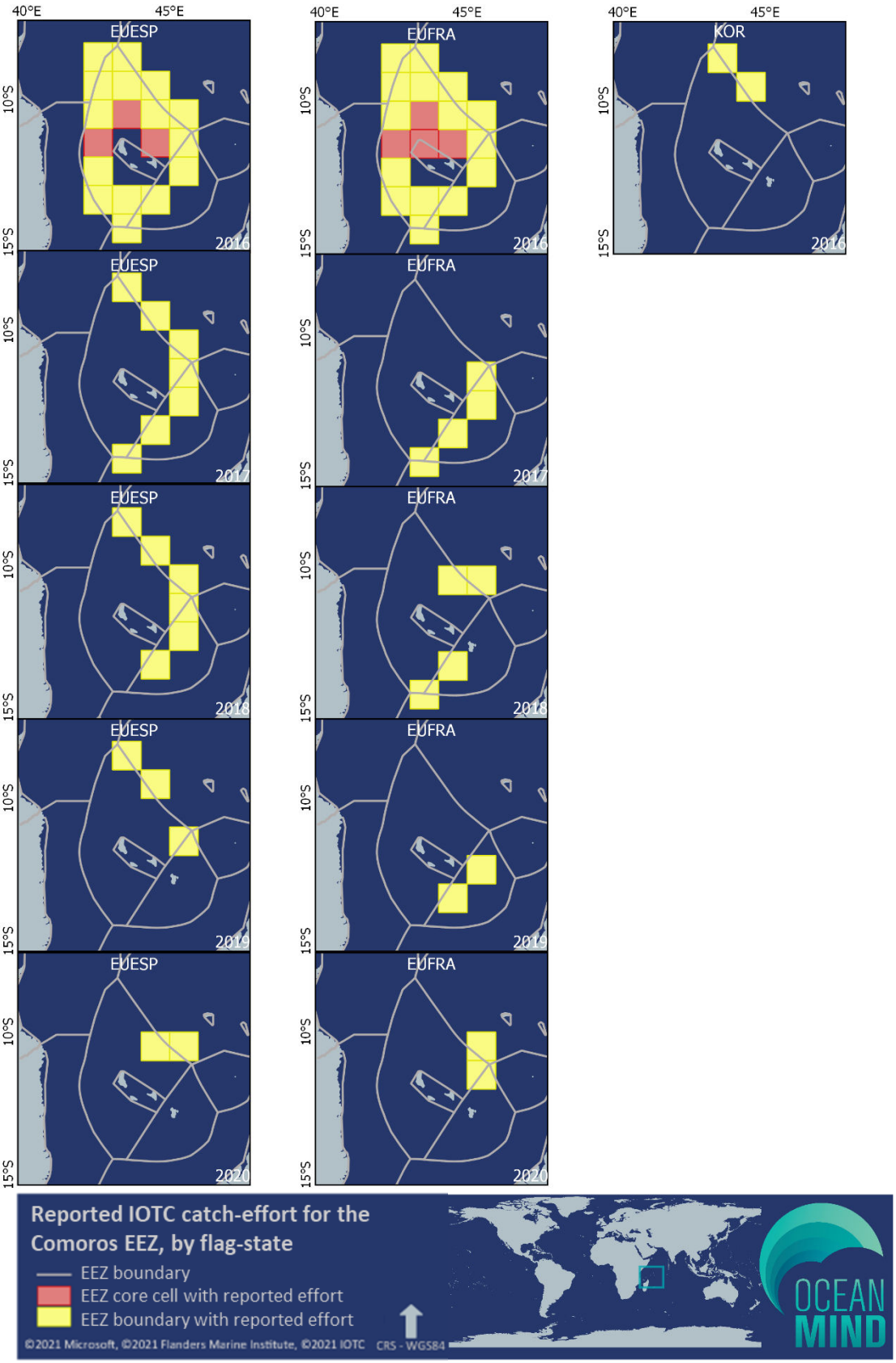


Figure 2: Location of EUESP, EUFRA and KOR purse seine fishing effort associated with the Comoros EEZ in 2016-2020

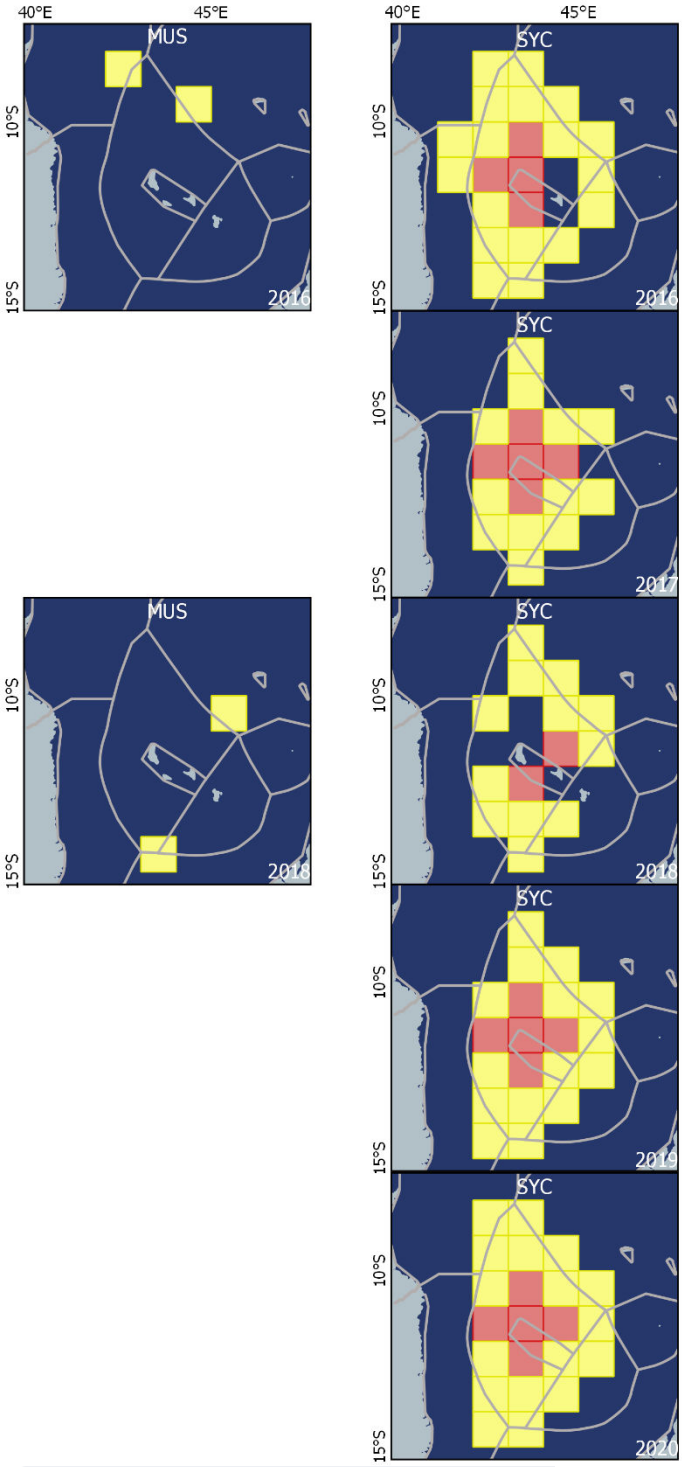


Table 1: Annual total effort (effort unit) and catch (metric tonnes) reported by purse seiners within and along the boundary of the Comoros EEZ for the period 2016-2020

Year	2016						2017						2018						2019						2020					
Location	EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary		
Effort months	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M
	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J
	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S
	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D
Flag State *Reported effort* Total catch (metric tonnes)	**EU-Spain** *153.3 FHOURS* 344.87 MT **EU-France** *246.2 FHOURS* 532.63 MT **Seychelles** *280.67 FHOURS* 796.34 MT			**EU-Spain** *1,398.5 FHOURS* 4,929.08 MT **EU-France** *1,036.9 FHOURS* 2,512.16 MT **South Korea** *5 SETS* 23 MT **Mauritius** *11 SETS* 257.68 MT **Seychelles** *1,303.5 FHOURS* 2,840.07 MT			**Seychelles** *101.14 FHOURS* 612.79 MT			**EU-Spain** *254.5 FHOURS* 1,317.59 MT **EU-France** *141.6 FHOURS* 367.21 MT **Seychelles** *443.17 FHOURS* 1,698.62 MT			**Seychelles** *45.37 FHOURS* 160.22 MT			**EU-Spain** *67.86 FHOURS* 164.85 MT **EU-France** *234.13 FHOURS* 995.17 MT **Mauritius** *6 SETS* 130.16 MT **Seychelles** *494.39 FHOURS* 1,218.92 MT			**Seychelles** *183.17 FHOURS* 514.81 MT			**EU-Spain** *50.69 FHOURS* 239.16 MT **EU-France** *5 SETS* 121.65 MT **Seychelles** *1,187.29 FHOURS* 3,852.25 MT			**Seychelles** *341.64 FHOURS* 1,165.74 MT			**EU-Spain** *23.41 FHOURS* 33.16 MT **EU-France** *3 SETS* 0 MT **Seychelles** *2,124.07 FHOURS* 7,308.8 MT		

4.2 French Republic (Overseas Departments, Territories and Regions)

Analysis for the French Republic as a coastal state in the western Indian Ocean included several islands and island groups, namely the Overseas Departments of Mayotte and Réunion and part of the French Southern and Antarctic Lands (Juan de Nova Island, Europa Island and Bassas da India). Consequently, spatial distribution of catch-effort in this coastal state was dispersed considerably.

Catch-effort was reported by 5 flag-states in grid cells within, or along the boundary of, the France EEZ for the period 2016-2020 (Figures 4-5). Catch-effort was reported by the fleets EUESP (2016-2020), EUFRA (2016-2020), KOR (2016), MUS (2016, 2018-2020) and SYC (2016-2020). Catch-effort from surface gears was reported both from boundary cells and inside the France EEZ for these flag states, although only SYC reported catch-effort from grid cells within the EEZ in 2019 and 2020. Although catch-effort was reported across months, highest catch-effort was generally reported in the first six months of the year (Table 2). Catch-effort was generally consistent in duration and weight as reported by flag states in the France EEZ across the analysis period and showed similar trends to that shown by the neighbouring Comoros EEZ.

Reported catch-effort was not spatially consistent across the France EEZ, with only EUESP and SYC reporting catch-effort entirely within the EEZ of Europa Island, and only SYC reporting catch-effort in grid cells entirely within the EEZ of Réunion.

When interpreting the reported catch-effort along the EEZ boundary of the Mayotte and Réunion Departments, and the islands of Juan de Nova and Bassas da India, it is important to consider that all boundaries of these feature EEZs are contiguous with other coastal-states. Consequently, any catch-effort reported in these boundary cells for the analysis period 2016-2020 must have occurred within the jurisdiction of at least one coastal-states and thus would require access agreements(s).

Figure 4: Location of EUESP, EUFRA and KOR purse seine fishing effort associated with the France EEZs in 2016-2020

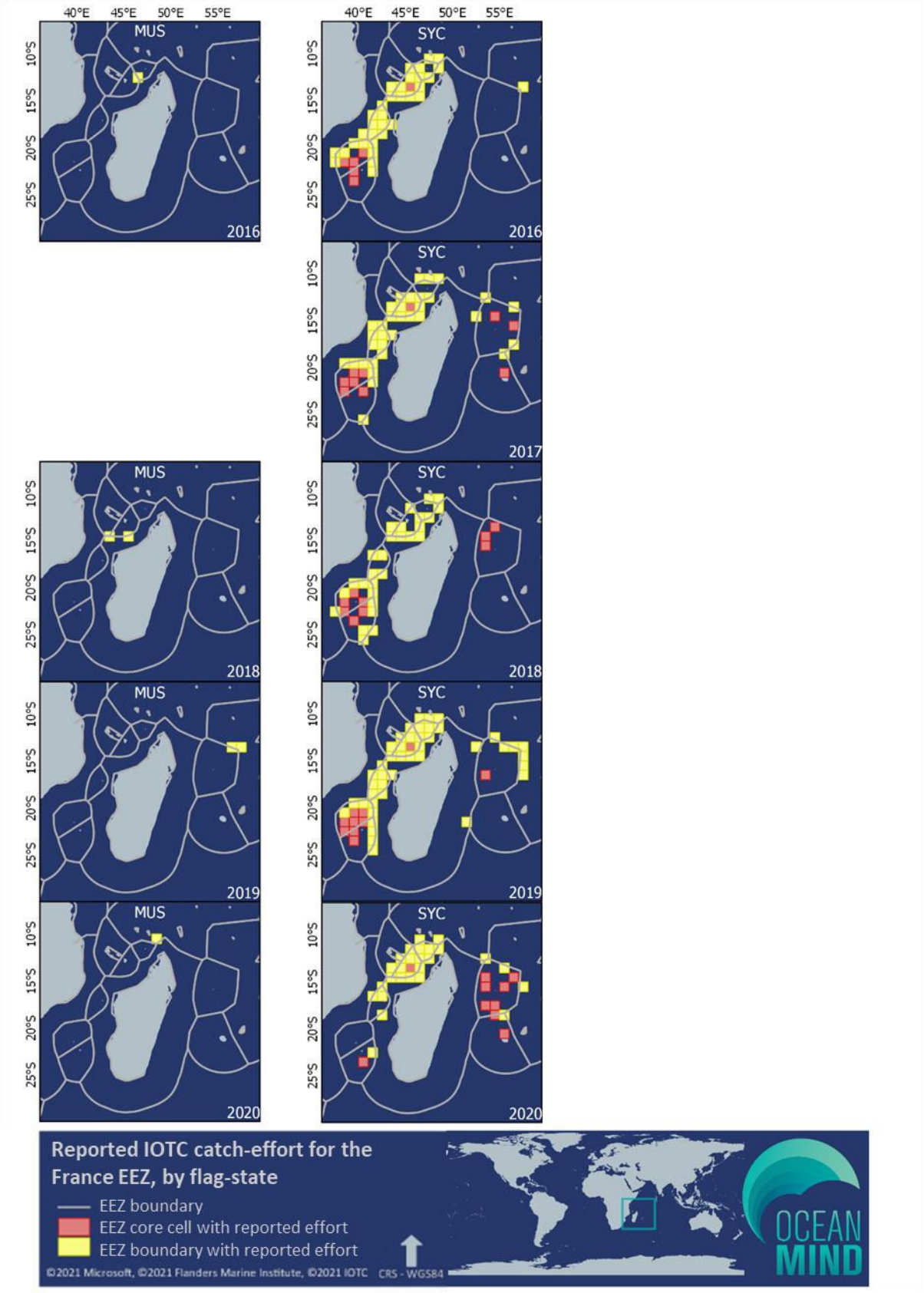


Figure 5: Location of MUS and SYC purse seine fishing effort associated with the France EEZs in 2016-2020

Table 2: Annual total effort (effort unit) and catch (metric tonnes) reported by purse seiners within and along the boundary of the France EEZs for the period 2016-2020

Year	2016						2017						2018						2019						2020					
Location	EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary		
Effort months	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M
	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J
	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S
	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D
Flag State *Reported effort* Total catch (metric tonnes)	**EU-Spain** *234.4 FHOURS* 543.51 MT **EU-France** *65.3 FHOURS* 104.34 MT **Seychelles** *277.29 FHOURS* 672.27 MT			**EU-Spain** *2,008.8 FHOURS* 6,006.01 MT **EU-France** *1,368.3 FHOURS* 1,818.46 MT **South Korea** *4 SETS* 70 MT **Mauritius** *1 SETS* 34.75 MT **Seychelles** *1,550.9 FHOURS* 3,221.76 MT			**EU-Spain** *328.2 FHOURS* 1,766.74 MT **EU-France** *108.6 FHOURS* 194.11 MT **Seychelles** *254.15 FHOURS* 932.89 MT			**EU-Spain** *1,996.5 FHOURS* 9,355.95 MT **EU-France** *936.2 FHOURS* *67 HOURS* 1,845.02 MT **Seychelles** *1,304.42 FHOURS* 4,697.02 MT			**EU-Spain** *101.31 FHOURS* 343.53 MT **EU-France** *63.44 FHOURS* 55.15 MT **Seychelles** *90.48 FHOURS* 493.96 MT			**EU-Spain** *715.35 FHOURS* 1,937.88 MT **EU-France** *1,047.02 FHOURS* 2,559.59 MT **Mauritius** *8 SETS* 173.35 MT **Seychelles** *1,120.99 FHOURS* 3,396.04 MT			**Seychelles** *408.46 FHOURS* 1,941.53 MT			**EU-Spain** *67.17 FHOURS* 148.5 MT **EU-France** *11 SETS* 257.18 MT **Mauritius** *3 SETS* 28.41 MT **Seychelles** *3,299.14 FHOURS* 11,691.98 MT			**Seychelles** *398.84 FHOURS* 797.38 MT			**EU-Spain** *12.82 FHOURS* 0 MT **EU-France** *5 SETS* 9.43 MT **Mauritius** *1 SETS* 57.65 MT **Seychelles** *3,974.88 FHOURS* 14,786.91 MT		

4.3 Republic of India

Catch-effort was reported by 5 flag-states in grid cells within, or along the boundary of, the India EEZ for the period 2016-2020 (Figures 6-7). Only the part of the Indian EEZ that fell within the western Indian Ocean AOI was considered in the catch-effort calculations for this coastal state. Catch-effort was reported by the fleets EUESP (2017-2020), EUFRA (2018-2020), KOR (2019), MUS (2020) and SYC (2017-2020). Relatively little catch-effort was reported from grid cells inside the EEZ, and where EEZ catch-effort was present this was generally restricted to a limited number of cells at around 15°N (Figures 6-7). Despite a relatively limited spatial extent within EEZ grid cells, fishing effort was associated with significant catch weight for purse seiners of the EUESP fleets, with EUESP reporting 240.7 MT (2018) and 543.53 MT (2019) and SYC reporting 57.92 MT (2018) and 184.03 MT (2019) (Table 3).

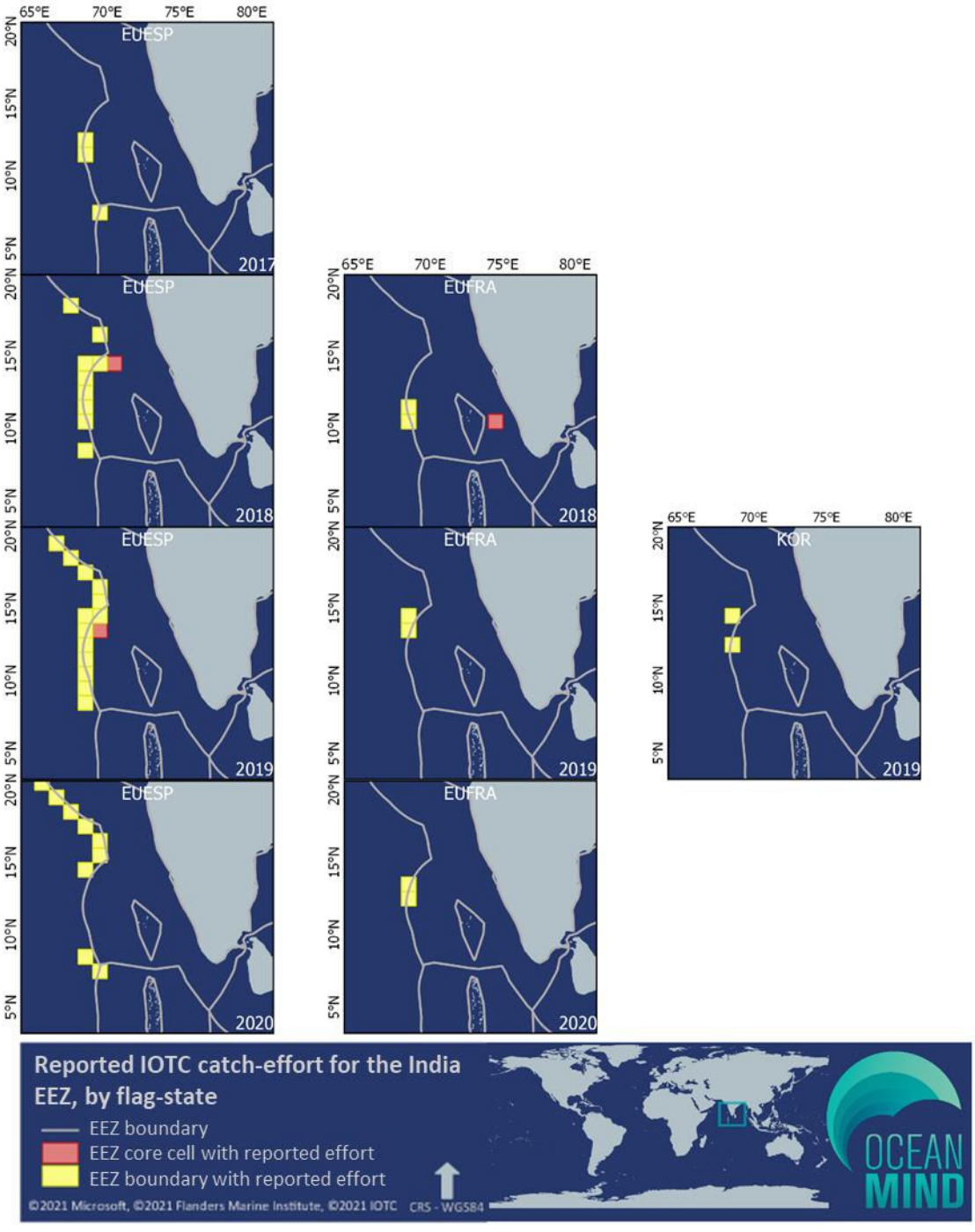


Figure 6: Location of EUESP, EUFRA and KOR purse seine fishing effort associated with the India EEZ in 2017-2020

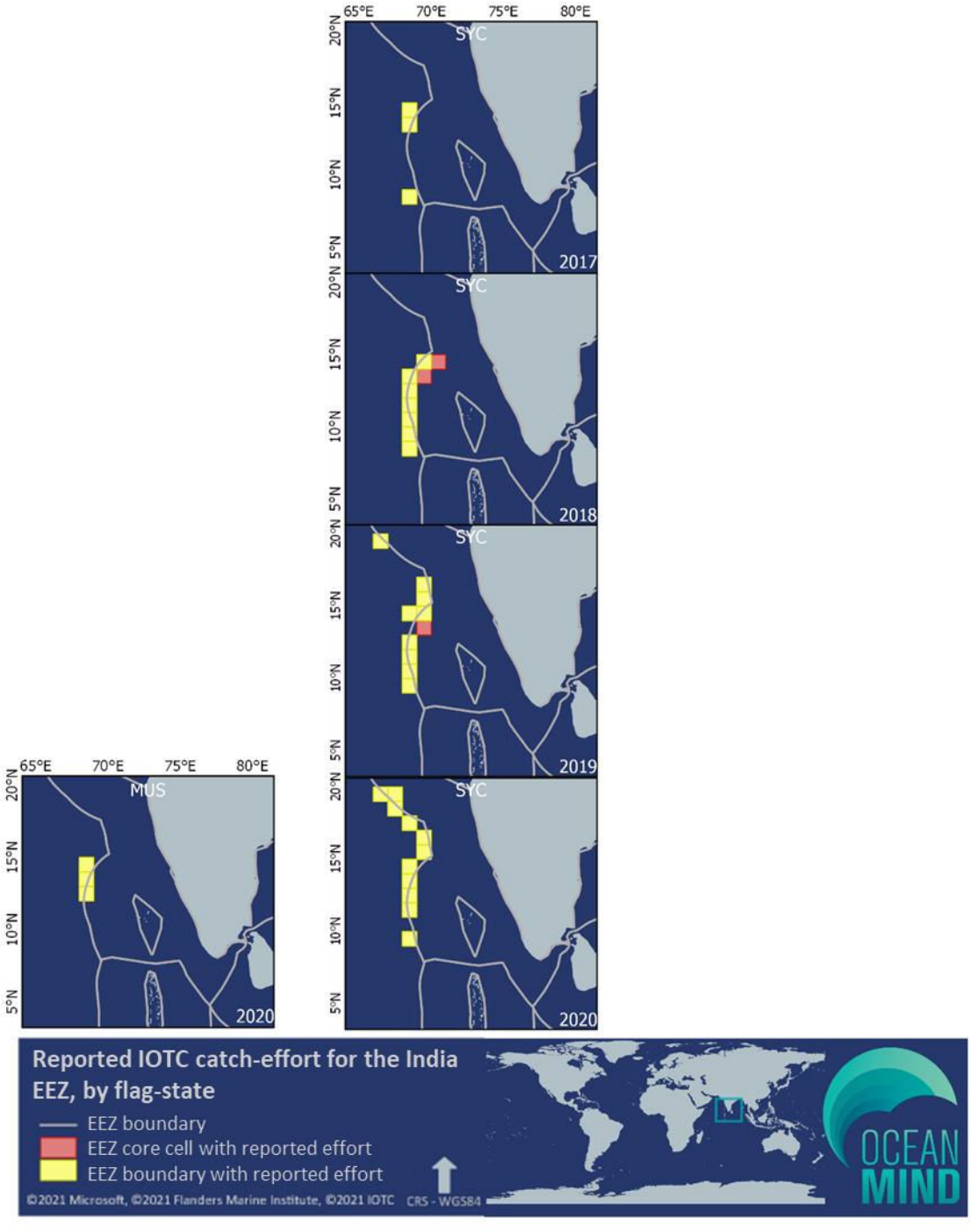


Figure 7: Location of MUS and SYC purse seine fishing effort associated with the India EEZ in 2017-2020

Table 3: Annual total effort (effort unit) and catch (metric tonnes) reported by purse seiners within and along the boundary of the India EEZ for the period 2016-2020

Year	2016						2017						2018						2019						2020					
Location	EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary		
Effort months	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M
	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J
	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S
	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D
Flag State *Reported effort* Total catch (metric tonnes)										**EU-Spain** *30.9 FHOURS* 394.95 MT **Seychelles** *54.21 FHOURS* 215.33 MT			**EU-Spain** *25.52 FHOURS* 240.7 MT **EU-France** *12.35 FHOURS* 0 MT **Seychelles** *20.93 FHOURS* 57.92 MT			**EU-Spain** *268.87 FHOURS* 1,575.59 MT **EU-France** *36.92 FHOURS* 147 MT **Seychelles** *147.29 FHOURS* 1,032.35 MT			**EU-Spain** *53.24 FHOURS* 543.53 MT **Seychelles** *26.39 FHOURS* 184.03 MT			**EU-Spain** *464.41 FHOURS* 3,769.37 MT **EU-France** *2 SETS* 32.47 MT **South Korea** *2 SETS* 32 MT **Seychelles** *169.52 FHOURS* 970.69 MT						**EU-Spain** *357.37 FHOURS* 2,623.6 MT **EU-France** *2 SETS* 4.75 MT **Mauritius** *3 SETS* 89.29 MT **Seychelles** *400.92 FHOURS* 1,781.16 MT		

4.4 Islamic Republic of Iran

Fishing effort was only reported in grid cells along the boundary of the Iran EEZ by a single flag-state (SYC) in 2017 and 2019 (Table 4). However, it is unclear whether this effort was within the Iran EEZ or the contiguous Oman EEZ (Figure 8).

Figure 8: Location of SYC purse seine fishing effort associated with the Iran EEZ in 2017-2019

Table 4: Annual total effort (effort unit) and catch (metric tonnes) reported by purse seiners within and along the boundary of the Iran EEZ for the period 2016-2020

Year	2016						2017						2018						2019						2020					
Location	EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary		
Effort months	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M
	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J
	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S
	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D
Flag State *Reported effort* Total catch (metric tonnes)										**Seychelles** *24.44 FHOURS* 0 MT												**Seychelles** *13 FHOURS* 0 MT								

4.5 Republic of Kenya

Catch-effort was reported by 5 flag-states in grid cells within, or along the boundary of, the Kenya EEZ for the period 2016-2020 (Figures 9-10). Catch-effort was reported by the fleets EUESP (2016-2020), EUFRA (2016-2020), KOR (2016, 2018-2020), MUS (2016-2017, 2019-2020) and SYC (2016-2020). Catch-effort was reported from grid cells inside the EEZ by 4 flag-states, with only SYC reporting catch-effort within the EEZ after 2017. Where catch-effort was reported along the Kenya EEZ boundary, this catch-effort was spread across the year with no clear high-effort periodicity (Table 5).

Analysis of catch-effort reported by flag-states in the maritime territory disputed between Kenya and Somalia is presented separately from these coastal states (section 4.14).

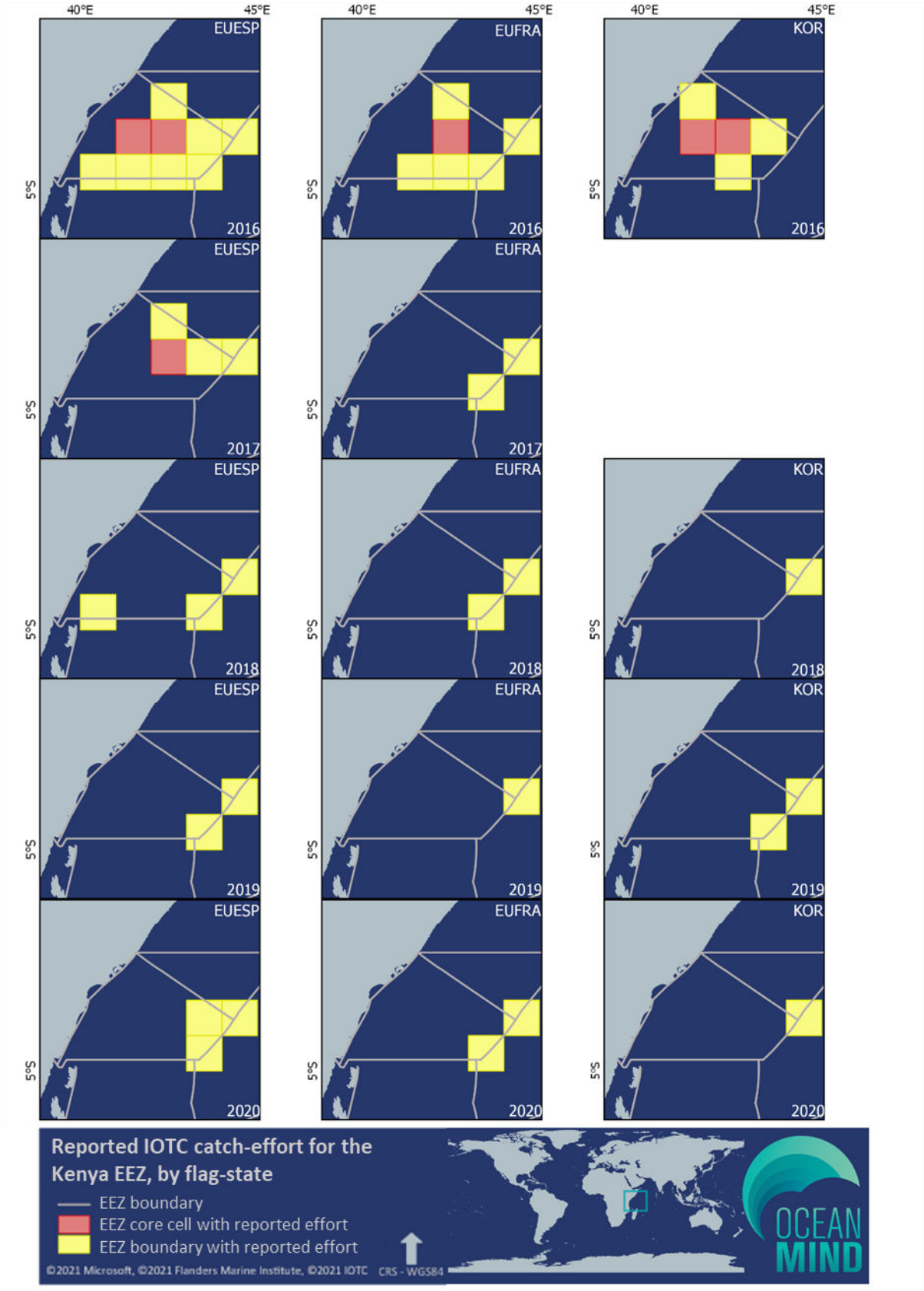


Figure 9: Location of EUESP, EUFRA and KOR purse seine fishing effort associated with the Kenya EEZ in 2016-2020

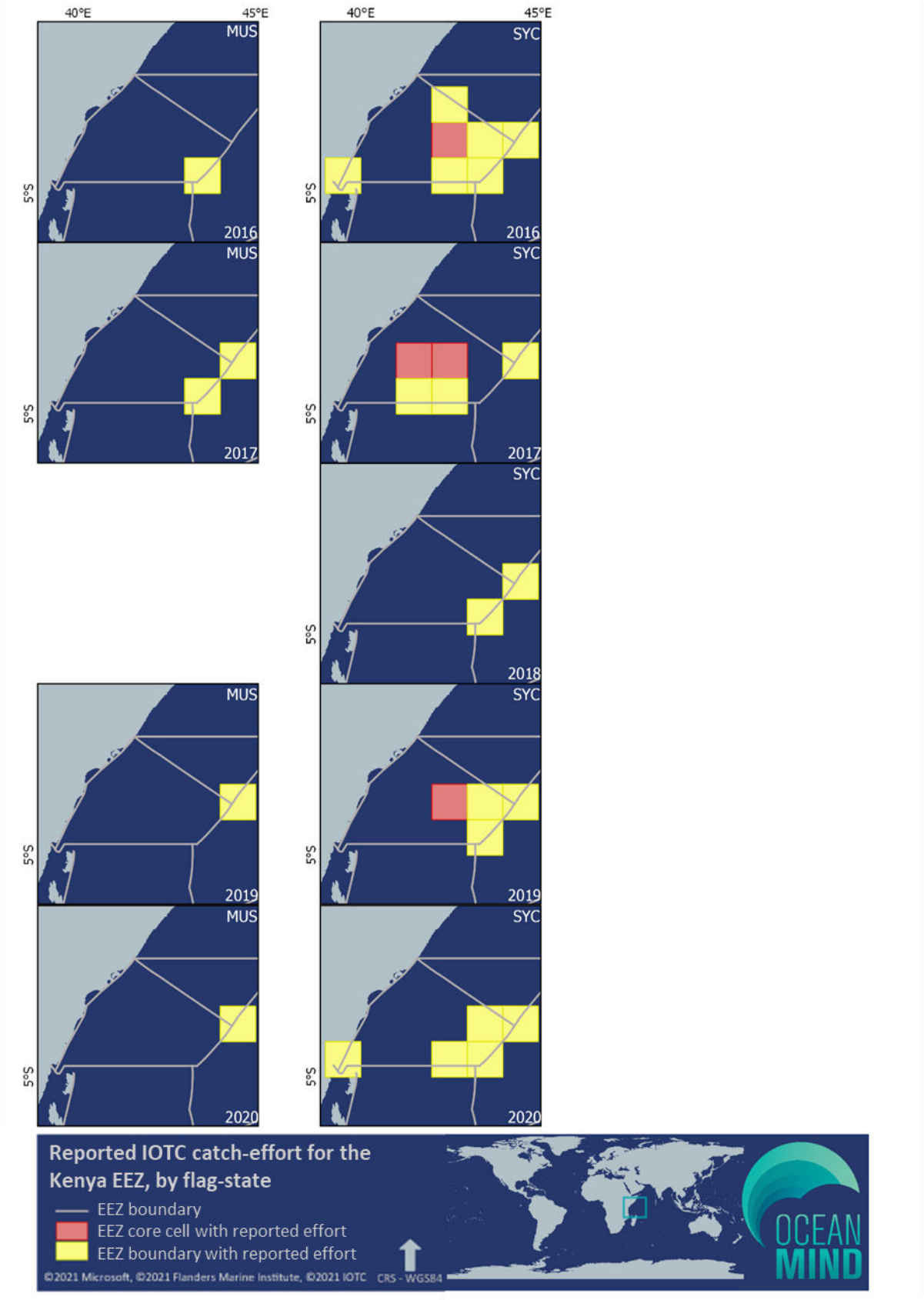


Figure 10: Location of MUS and SYC purse seine fishing effort associated with the Kenya EEZ in 2016-2020

Table 5: Annual total effort (effort unit) and catch (metric tonnes) reported by purse seiners within and along the boundary of the Kenya EEZ for the period 2016-2020

Year	2016						2017						2018						2019						2020					
Location	EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary		
Effort months	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M
	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J
	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S
	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D
Flag State *Reported effort* Total catch (metric tonnes)	**EU-Spain** *59.8 FHOURS* 209.82 MT **EU-France** *11.9 FHOURS* 0 MT **South Korea** *5 SETS* 138 MT **Seychelles** *70.33 FHOURS* 522.31 MT			**EU-Spain** *467.8 FHOURS* 1,321.32 MT **EU-France** *131.2 FHOURS* 134.86 MT **South Korea** *5 SETS* 107 MT **Mauritius** *5 SETS* 118.61 MT **Seychelles** *589.29 FHOURS* 1,249.07 MT			**EU-Spain** *6.2 FHOURS* 36.93 MT **Seychelles** *25.22 FHOURS* 95.02 MT			**EU-Spain** *109 FHOURS* 1,079.89 MT **EU-France** *102.6 FHOURS* 134.02 MT **Mauritius** *3 SETS* 29.95 MT **Seychelles** *91.91 FHOURS* 465.82 MT						**EU-Spain** *167.75 FHOURS* 1,249.61 MT **EU-France** *72.54 FHOURS* 88.63 MT **South Korea** *1 SET* 10 MT **Seychelles** *97.5 FHOURS* 258.52 MT			**Seychelles** *6.63 FHOURS* 50.17 MT			**EU-Spain** *356.41 FHOURS* 1,993.61 MT **EU-France** *21 SETS* 533.8 MT **South Korea** *5 SETS* 205 MT **Mauritius** *1 SET* 44.21 MT **Seychelles** *153.92 FHOURS* 691.68 MT						**EU-Spain** *379.95 FHOURS* 724.88 MT **EU-France** *6 SETS* 60.8 MT **South Korea** *1 SET* 50 MT **Mauritius** *1 SET* 33.94 MT **Seychelles** *224.24 FHOURS* 59.16 MT		

4.6 Republic of Madagascar

Catch-effort was reported by 5 flag-states in grid cells within, or along the boundary of, the Madagascar EEZ for the period 2016-2020 (Figures 11-12). Catch-effort was reported by the fleets EUESP (2016-2019), EUFRA (2016-2020), KOR (2016, 2019), MUS (2016, 2018, 2020) and SYC (2016-2020). All 5 flag-states reported catch-effort within grid cells inside the EEZ during the analysis period, although only SYC reported catch-effort within the Madagascar EEZ after 2018 (Table 6).

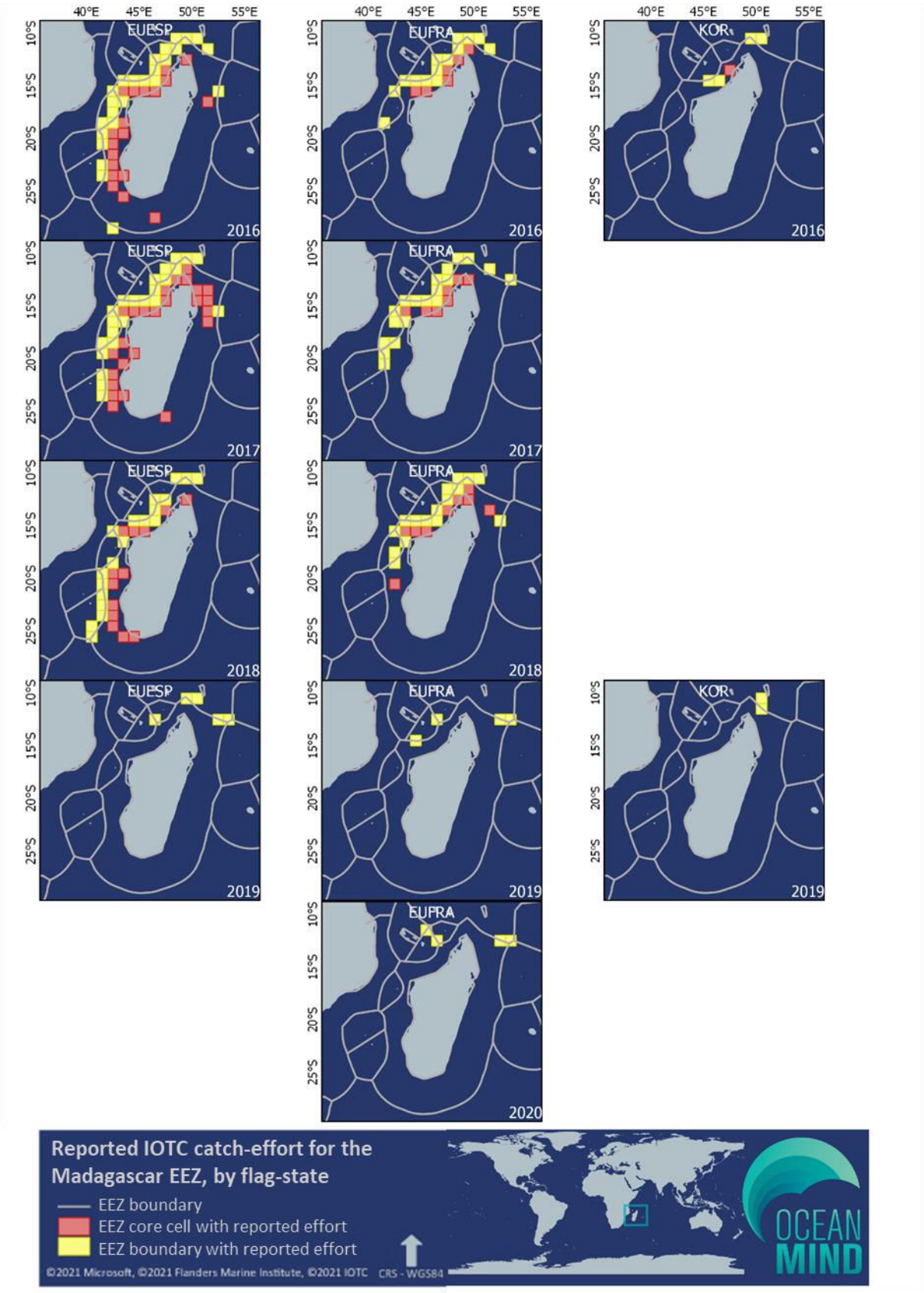


Figure 11: Location of EUESP, EUFRA and KOR purse seine fishing effort associated with the Madagascar EEZ in 2016-2020

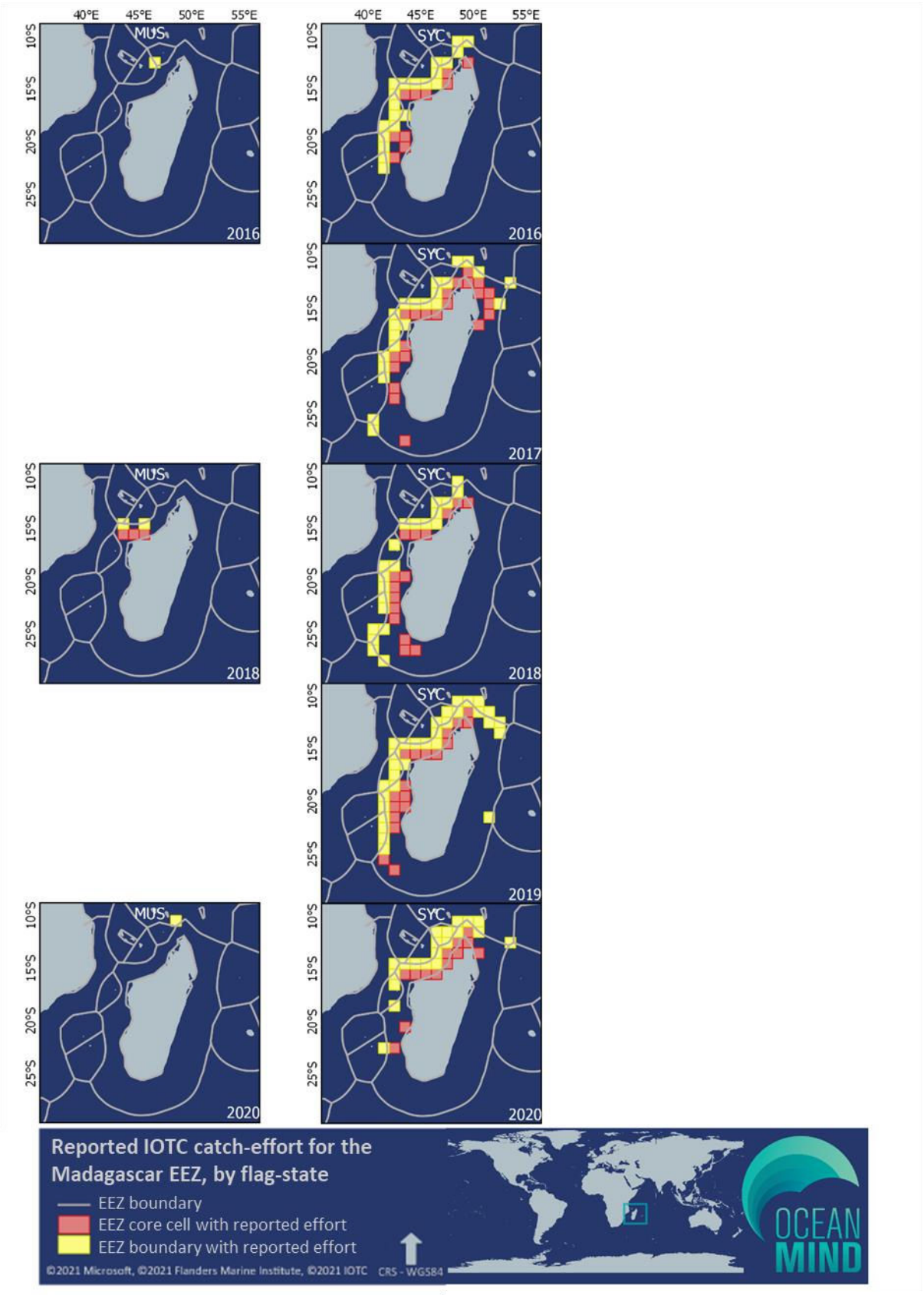


Figure 12: Location of MUS and SYC purse seine fishing effort associated with the Madagascar EEZ in 2016-2020

Table 6: Annual total effort (effort unit) and catch (metric tonnes) reported by purse seiners within and along the boundary of the Madagascar EEZ for the period 2016-2020

Year	2016						2017						2018						2019						2020					
Location	EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary		
Effort months	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M
	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J
	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S
	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D
Flag State *Reported effort* Total catch (metric tonnes)	**EU-Spain** *711.6 FHOURS* 2,053.12 MT **EU-France** *437.4 FHOURS* 1,107.58 MT **South Korea** *2 SETS* 40 MT **Seychelles** *820.82 FHOURS* 2,703.15 MT			**EU-Spain** *1,644.1 FHOURS* 4,961.12 MT **EU-France** *1,185.9 FHOURS* 1,885.12 MT **South Korea** *9 SETS* 244 MT **Mauritius** *1 SETS* 34.75 MT **Seychelles** *1,199.77 FHOURS* 2,443.44 MT			**EU-Spain** *843.7 FHOURS* *61 HOURS* 4,486.13 MT **EU-France** *114.1 FHOURS* *42 HOURS* 243.47 MT **Seychelles** *583.18 FHOURS* 2,087.06 MT			**EU-Spain** *1,648.6 FHOURS* 7,820.04 MT **EU-France** *684.2 FHOURS* 1,374.8 MT **Seychelles** *908.44 FHOURS* 3,008.18 MT			**EU-Spain** *308.75 FHOURS* 1,046.89 MT **EU-France** *436.93 FHOURS* 1,324.07 MT **Mauritius** *8 SETS* 185.23 MT **Seychelles** *510.51 FHOURS* 2,033.14 MT			**EU-Spain** *643.57 FHOURS* 1,615.79 MT **EU-France** *893.36 FHOURS* 2,372.49 MT **Mauritius** *8 SETS* 173.35 MT **Seychelles** *893.1 FHOURS* 2,912.17 MT			**Seychelles** *1,638.26 FHOURS* 6,242.37 MT			**EU-Spain** *157.5 FHOURS* 952.39 MT **EU-France** *6 SETS* 174.13 MT **South Korea** *3 SETS* 75 MT **Seychelles** *2,827.37 FHOURS* 10,708.57 MT			**Seychelles** *1,271.53 FHOURS* 4,504.76 MT			**EU-France** *3 SETS* 46.04 MT **Mauritius** *1 SETS* 57.65 MT **Seychelles** *3,169.79 FHOURS* 11,730.21 MT		

4.7 Republic of Maldives

Catch-effort was reported by 6 flag-states in grid cells within, or along the boundary of, the Maldives EEZ for the period 2016-2020 (Figures 13-14). Catch-effort was reported by the fleets EUESP (2016-2020), EUFRA (2016-2020), JPN (2018-2020), KOR (2016-2018, 2020), MUS (2016-2018) and SYC (2016-2019). EUFRA reported effort inside the Maldives EEZ in 2018 only, and SYC in 2017 and 2018 (Table 7).

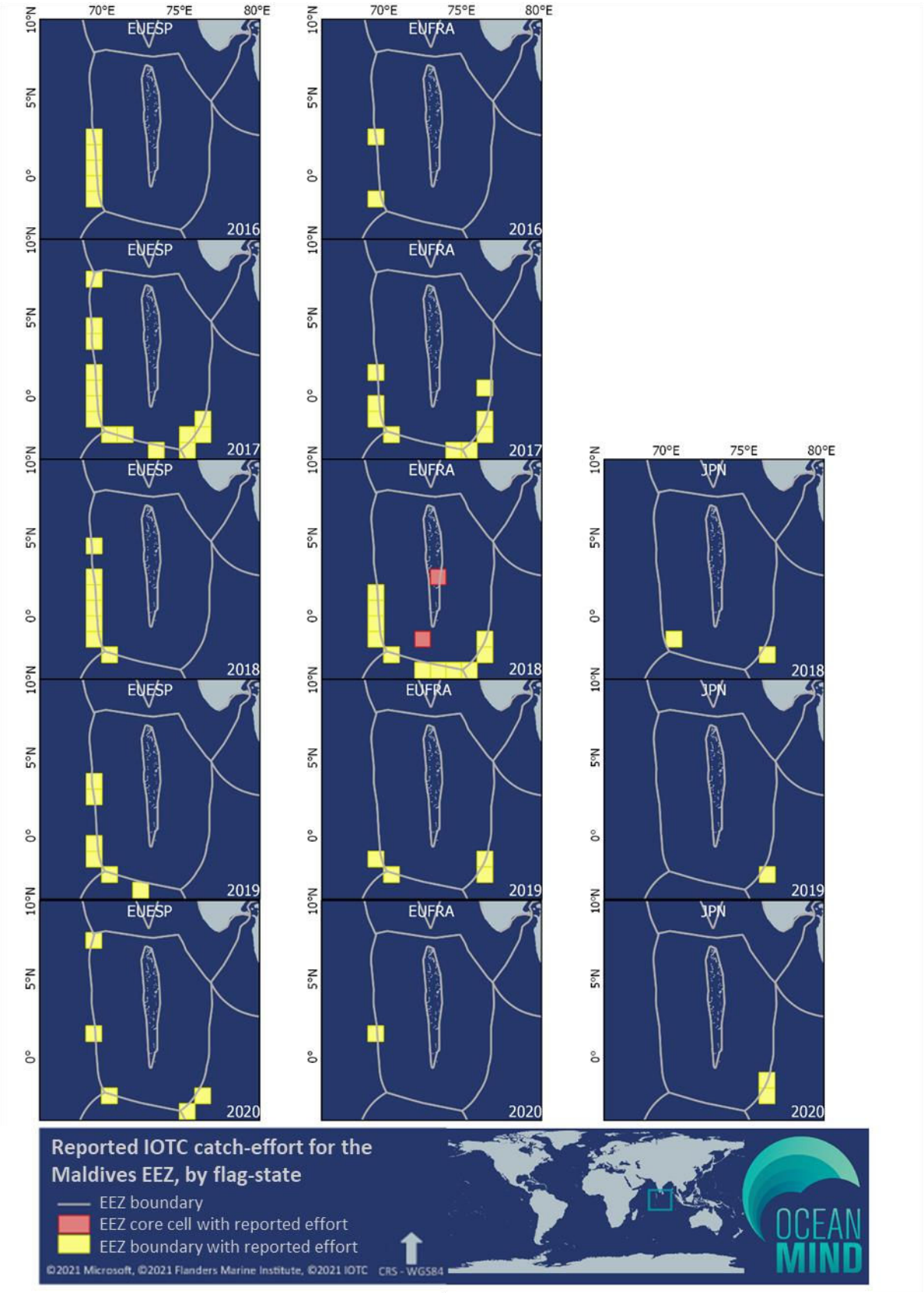


Figure 13: Location of EUESP, EUFRA and JPN purse seine fishing effort associated with the Maldives EEZ in 2016-2020

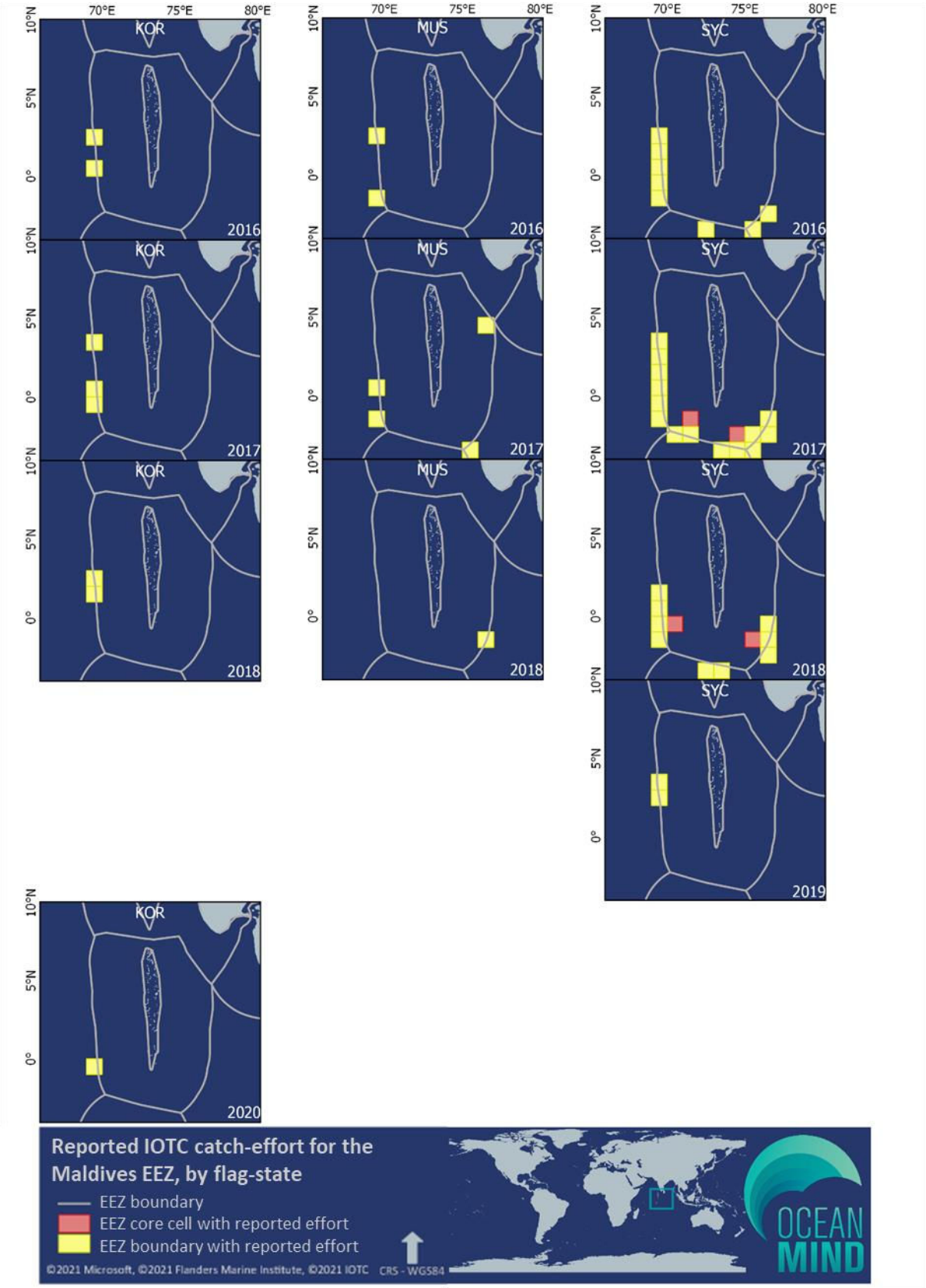


Figure 14: Location of KOR, MUS and SYC purse seine fishing effort associated with the Maldives EEZ in 2016-2020

Table 7: Annual total effort (effort unit) and catch (metric tonnes) reported by purse seiners within and along the boundary of the Maldives EEZ for the period 2016-2020

Year	2016						2017						2018						2019						2020					
Location	EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary		
Effort months	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M
	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J
	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S
	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D
Flag State *Reported effort* Total catch (metric tonnes)				**EU-Spain** *96.5 FHOURS* 239.57 MT **EU-France** *24.2 FHOURS* 167.85 MT **South Korea** *8 SETS* 165 MT **Mauritius** *3 SETS* 57.25 MT **Seychelles** *170.56 FHOURS* 681.74 MT			**Seychelles** *26 FHOURS* 0 MT			**EU-Spain** *351.6 FHOURS* 731.83 MT **EU-France** *400.1 FHOURS* *120 HOURS* 718.98 MT **South Korea** *4 SETS* 70.07 MT **Mauritius** *13 SETS* 351.77 MT **Seychelles** *244.14 FHOURS* 558.95 MT			**EU-France** *24.05 FHOURS* 0 MT **Seychelles** *26.26 FHOURS* 0 MT			**EU-Spain** *148.28 FHOURS* 901.54 MT **EU-France** *379.73 FHOURS* *120 HOURS* 988.46 MT **Japan** *2 SETS* 40 MT **South Korea** *3 SETS* 25 MT **Mauritius** *2 SETS* 116.29 MT **Seychelles** *320.97 FHOURS* 1,157.46 MT				**EU-Spain** *101.14 FHOURS* 342.14 MT **EU-France** *11 SETS* 165.61 MT **Japan** *2 SETS* 115 MT **Seychelles** *26 FHOURS* 109.96 MT				**EU-Spain** *78.07 FHOURS* 243.36 MT **EU-France** *2 SETS* 56.92 MT **Japan** *3 SETS* 30 MT **South Korea** *1 SET* 30 MT	

4.8 Republic of Mauritius

Catch-effort was reported by 6 flag-states in grid cells within, or along the boundary of, the Mauritius EEZ for the period 2016-2020 (Figures 15-16). Catch-effort was reported by the fleets EUESP (2016-2020), EUFRA (2016-2020), KOR (2016-2018, 2020), MUS (2016-2020), SYC (2016-2020) and THA (2016-2017). THA reported catch-effort only in grid cells along the eastern boundary of the Mauritius EEZ, with catch-effort being reported in the same grid cell in both 2016 and 2017 (Figure 16). This catch-effort grid cell, as reported by the THA fleet, may be associated with the Saya de Mahla bank.

All other flag-states reported catch-effort in both the Mauritius EEZ and in grid cells along the boundary, with catch-effort being reported across multiple months (Table 8). Typically, catch-effort was distributed in the north of the Mauritius EEZ, with irregular distribution of catch-effort in grid cells in the central and southern EEZ (Figures 15-16). Of note was the reduction in effort and catch reported by EUESP in grid cells within the Mauritius EEZ from 2019 (328.66 FHOURS, 1,558.26 MT) to 2020 (37.59 FHOURS, 69.7 MT). Flag-states EUFRA and MUS also reported significant reductions in catch-effort in the Mauritius EEZ over the same period (Table 8).

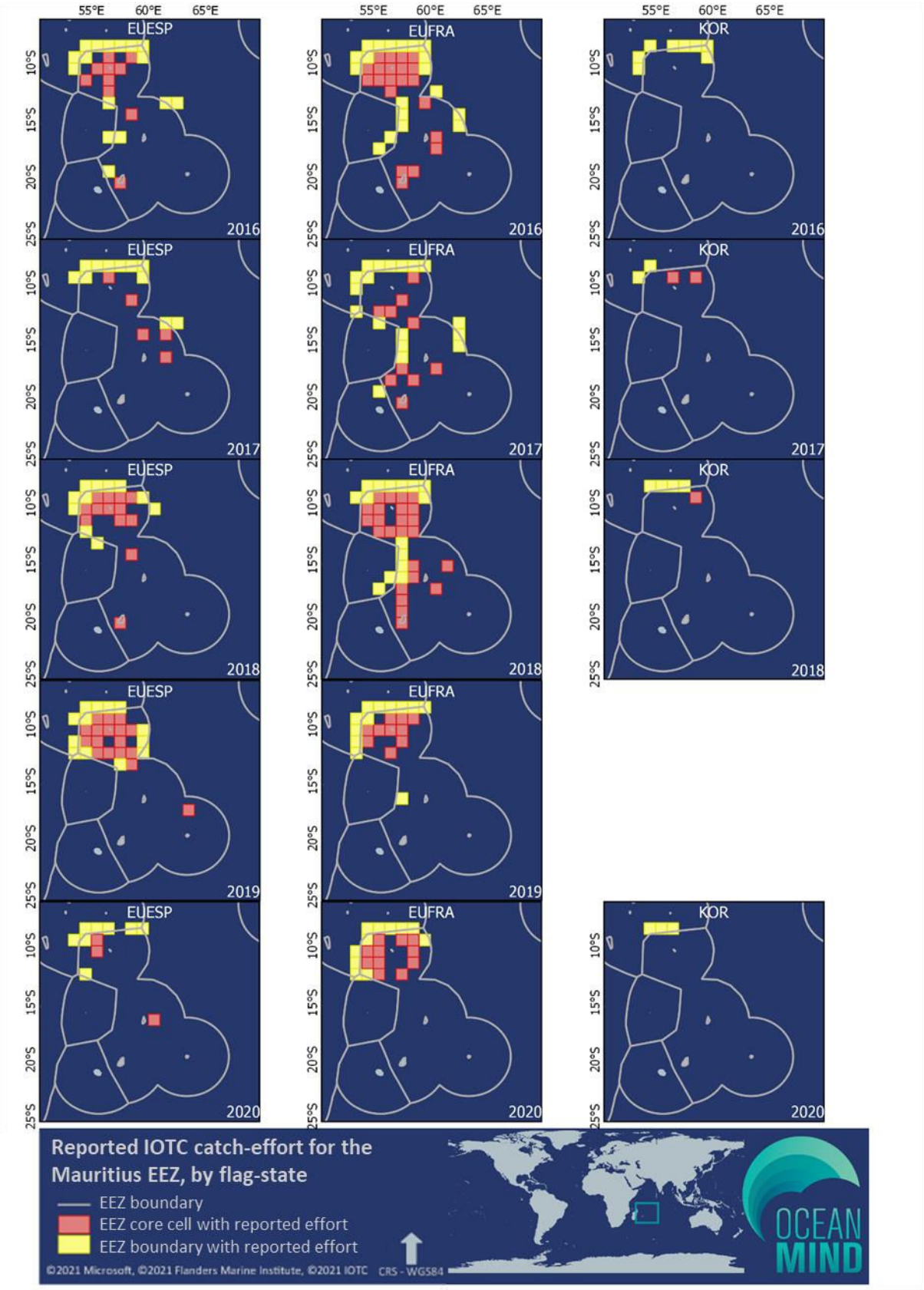


Figure 15: Location of EUESP, EUFRA and KOR purse seine fishing effort associated with the Mauritius EEZ in 2016-2020

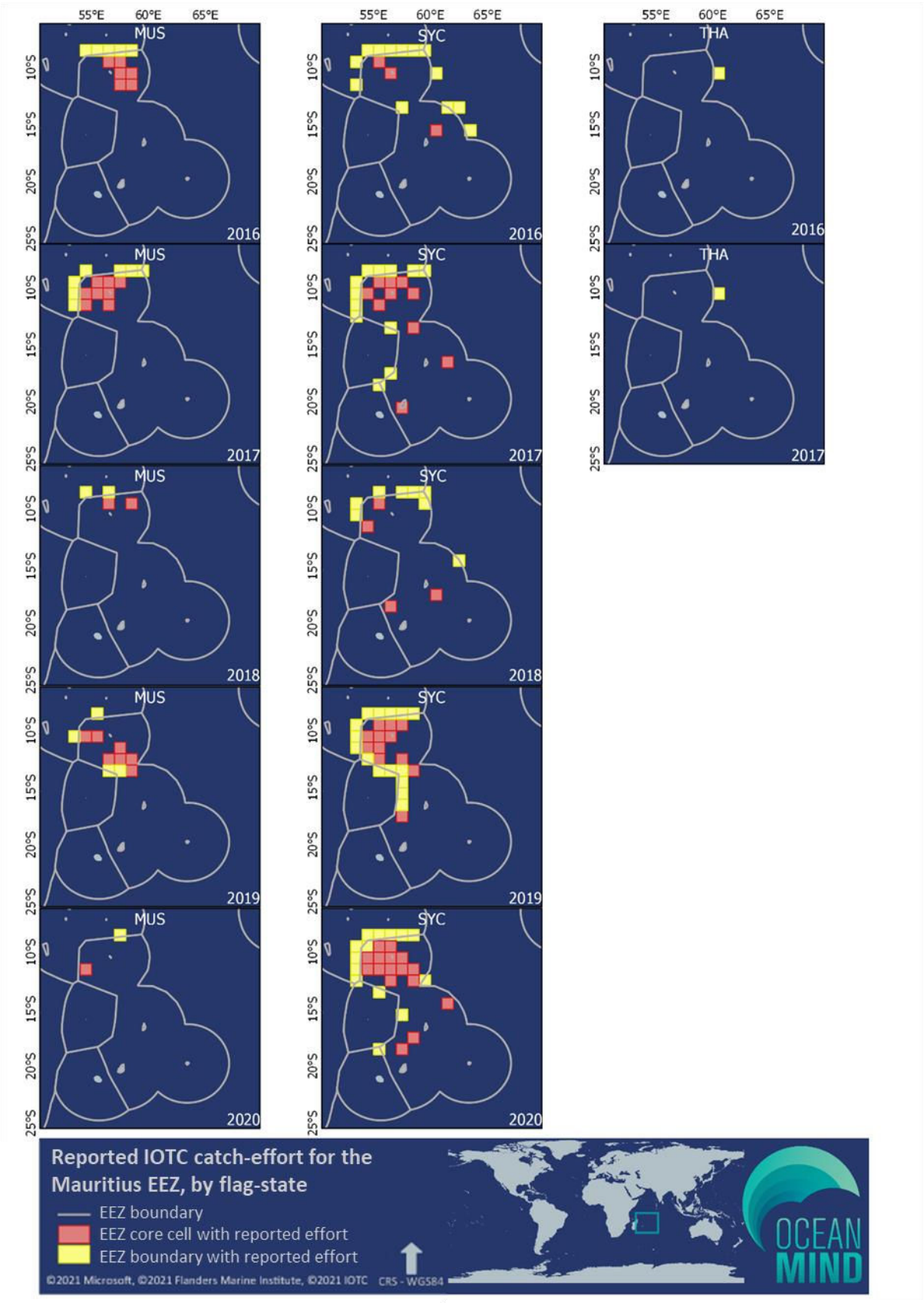


Figure 16: Location of EUESP, EUFRA and KOR purse seine fishing effort associated with the Mauritius EEZ in 2016-2020

Table 8: Annual total effort (effort unit) and catch (metric tonnes) reported by purse seiners within and along the boundary of the Mauritius EEZ for the period 2016-2020

Year	2016						2017						2018						2019						2020					
Location	EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary		
Effort months	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M
	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J
	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S
	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D
Flag State *Reported effort* Total catch (metric tonnes)	**EU-Spain** *126.6 FHOURS* 172.22 MT **EU-France** *911 FHOURS* 1,393.47 MT **Mauritius** *15 SETS* 297.49 MT **Seychelles** *41.34 FHOURS* 10.58 MT			**EU-Spain** *493.3 FHOURS* 611.21 MT **EU-France** *1,187.5 FHOURS* 1,317.73 MT **South Korea** *18 SETS* 278 MT **Mauritius** *10 SETS* 100.19 MT **Seychelles** *573.04 FHOURS* 582.91 MT **Thailand** *13 FHOURS* 2.42 MT			**EU-Spain** *74.1 FHOURS* *24 HOURS* 182.81 MT **EU-France** *191.5 FHOURS* *118 HOURS* 0 MT **South Korea** *2 SETS* 110.02 MT **Mauritius** *19 SETS* 391.15 MT **Seychelles** *160.29 FHOURS* 83.31 MT			**EU-Spain** *269.4 FHOURS* 670.85 MT **EU-France** *1,071.1 FHOURS* *82 HOURS* 2,006.26 MT **South Korea** *3 SETS* 88 MT **Mauritius** *18 SETS* 529.94 MT **Seychelles** *206.05 FHOURS* 71.85 MT **Thailand** *52 FHOURS* 15.07 MT			**EU-Spain** *211.54 FHOURS* 784.03 MT **EU-France** *755.43 FHOURS* 1,138.84 MT **South Korea** *1 SETS* 70 MT **Mauritius** *2 SETS* 42.2 MT **Seychelles** *79.17 FHOURS* 34.6 MT			**EU-Spain** *240.38 FHOURS* 1,302.03 MT **EU-France** *1,063.53 FHOURS* 1,743.23 MT **South Korea** *9 SETS* 153 MT **Mauritius** *3 SETS* 230.4 MT **Seychelles** *118.69 FHOURS* 312.9 MT			**EU-Spain** *328.66 FHOURS* 1,558.26 MT **EU-France** *35 SETS* 1,446.64 MT **Mauritius** *25 SETS* 851.45 MT **Seychelles** *303.68 FHOURS* 354.28 MT			**EU-Spain** *248.22 FHOURS* 908.13 MT **EU-France** *60 SETS* 1,932.31 MT **Mauritius** *5 SETS* 138.94 MT **Seychelles** *350.22 FHOURS* 110.51 MT			**EU-Spain** *37.59 FHOURS* 69.7 MT **EU-France** *45 SETS* 854.39 MT **Mauritius** *2 SETS* 0 MT **Seychelles** *329.68 FHOURS* 656.86 MT			**EU-Spain** *142.29 FHOURS* 378.69 MT **EU-France** *27 SETS* 603.59 MT **South Korea** *4 SETS* 75 MT **Mauritius** *2 SETS* 16.95 MT **Seychelles** *557.83 FHOURS* 1,122.66 MT		

4.9 Republic of Mozambique

Catch-effort was reported by 3 flag-states in grid cells within, or along the boundary of, the Mozambique EEZ for the period 2016-2020 (Figure 17). Catch-effort was reported by the fleets EUESP (2016-2018), EUFRA (2016-2018) and SYC (2016-2020). EUESP reported catch-effort in grid cells along the EEZ boundary in 2016-2018 but only within the Mozambique EEZ in 2016 (Table 9). EUFRA reported effort within the Mozambique EEZ in 2018 only, this being in grid cells on or close to the coast. Given the proximity of these grid cells to major urban centres and harbours, these catch-effort reports may also be associated with port activity by EUFRA vessels (Figure 17).

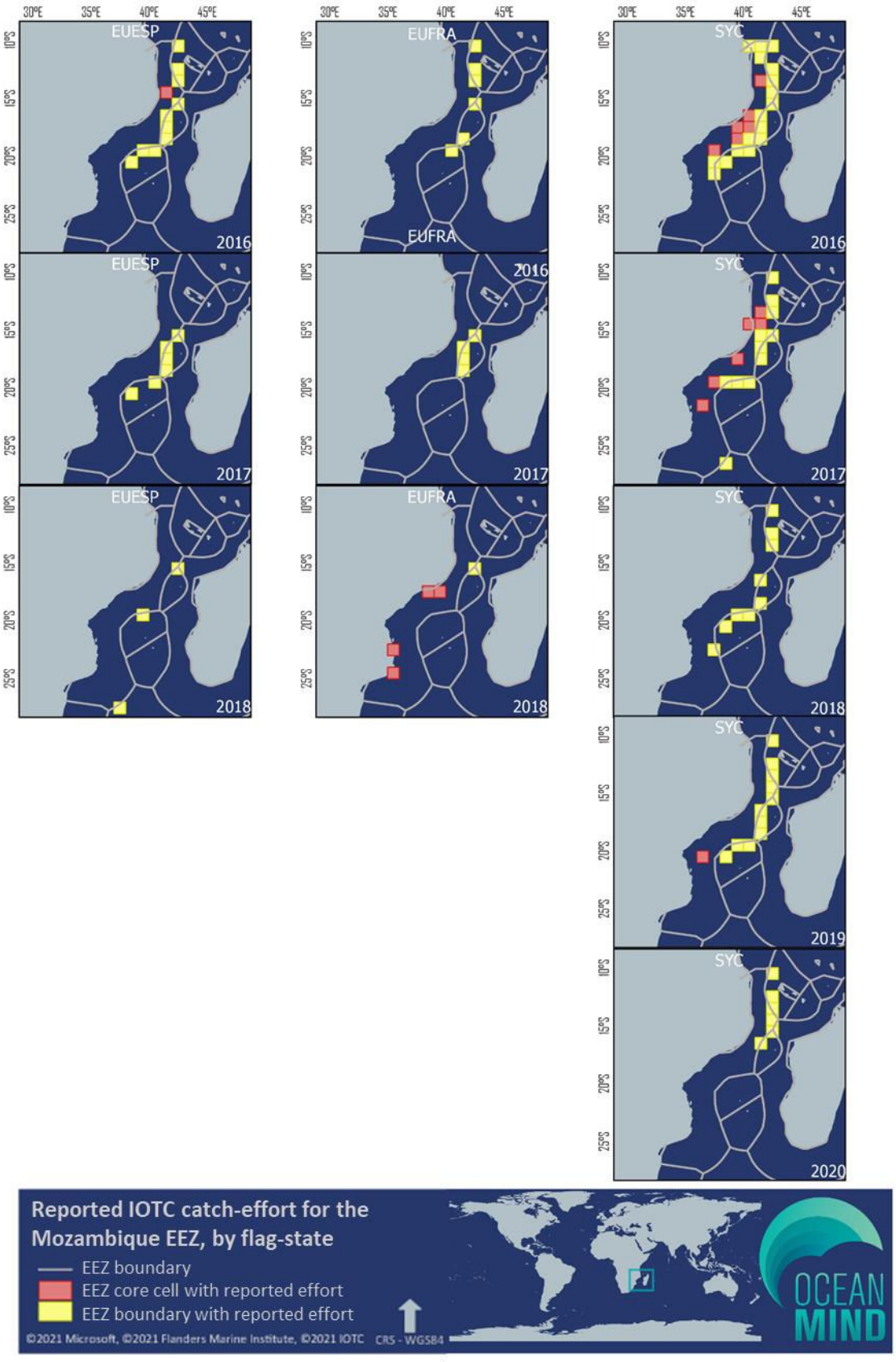


Figure 17: Location of EUESP, EUFRA and SYC purse seine fishing effort associated with the Mozambique EEZ in 2016-2020

Table 9: Annual total effort (effort unit) and catch (metric tonnes) reported by purse seiners within and along the boundary of the Mozambique EEZ for the period 2016-2020

Year	2016						2017						2018						2019						2020					
Location	EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary		
Effort months	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M
	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J
	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S
	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D
Flag State *Reported effort* Total catch (metric tonnes)	**EU-Spain** *12.2 FHOURS* 19 MT **Seychelles** *92.95 FHOURS* 372.76 MT			**EU-Spain** *434.2 FHOURS* 1,638.84 MT **EU-France** *248.8 FHOURS* 520.72 MT **Seychelles** *538.46 FHOURS* 1,251.86 MT			**Seychelles** *77.74 FHOURS* 67.82 MT			**EU-Spain** *123.6 FHOURS* 403.53 MT **EU-France** *158.7 FHOURS* 527.43 MT **Seychelles** *250.12 FHOURS* 713.58 MT			**EU-France** *48.36 FHOURS* 0 MT			**EU-Spain** *37.49 FHOURS* 97.8 MT **EU-France** *24.83 FHOURS* 202.51 MT **Seychelles** *243.62 FHOURS* 718.6 MT			**Seychelles** *12.09 FHOURS* 68.81 MT			**Seychelles** *532.22 FHOURS* 1,873.42 MT						**Seychelles** *404.69 FHOURS* 1,275.31 MT		

4.10 Sultanate of Oman

Catch-effort was reported by 4 flag-states in grid cells within, or along the boundary of, the Oman EEZ for the period 2016-2020 (Figure 18-19). Catch-effort was reported by the fleets EUESP (2018-2020), EUFRA (2020), MUS (2017, 2020) and SYC (2017-2020). Only SYC reported effort from grid cells inside the Oman EEZ, this being in 2017 and 2019 (Table 10). Most catch-effort reported for grid cells along the Oman EEZ boundary was along the high seas boundary, although SYC did report catch effort on the Oman EEZ boundary with United Arab Emirates and Iran in 2017 and 2019 (Figure 19).

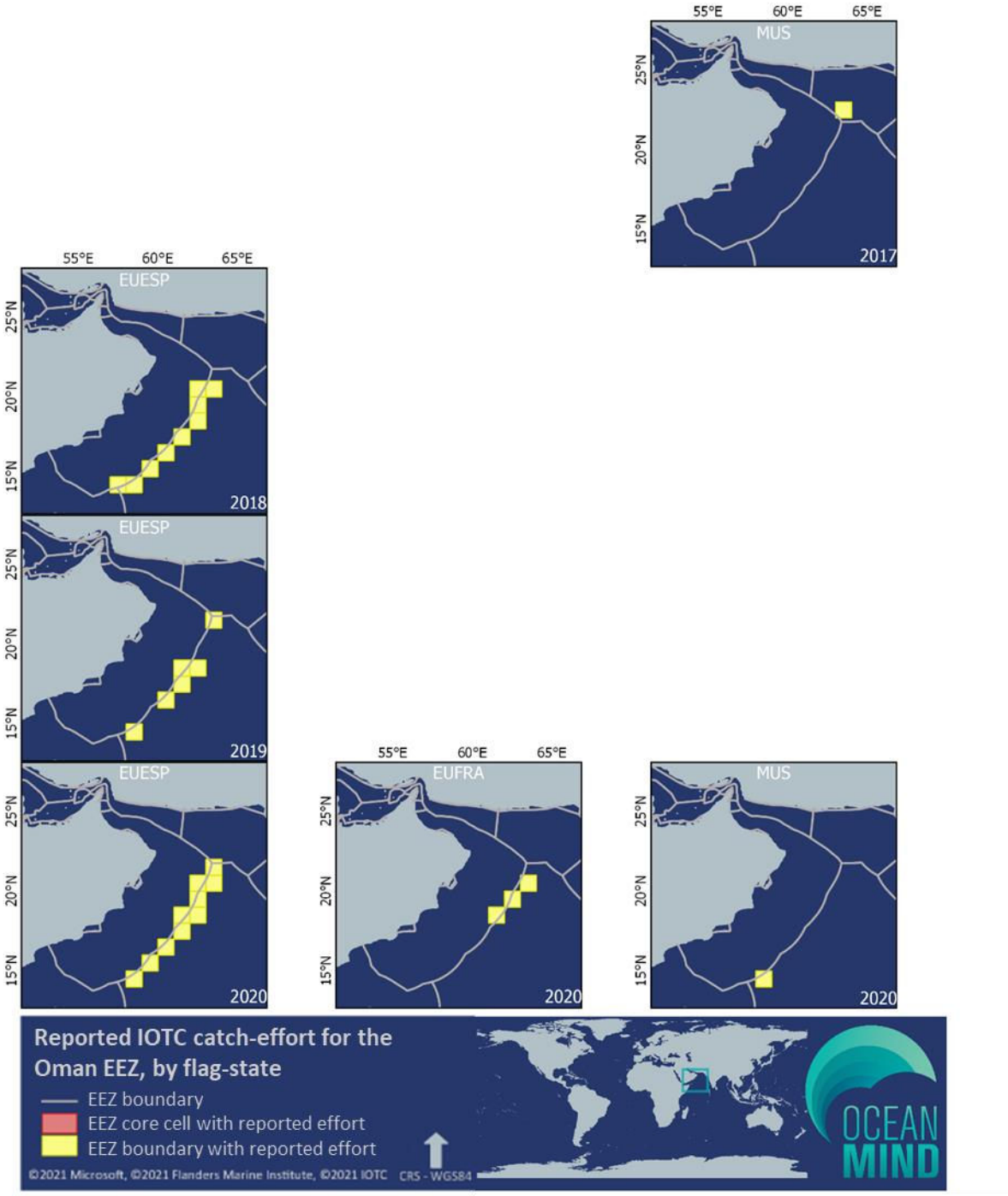


Figure 18: Location of EUESP, EUFRA and MUS purse seine fishing effort associated with the Oman EEZ in 2017-2020

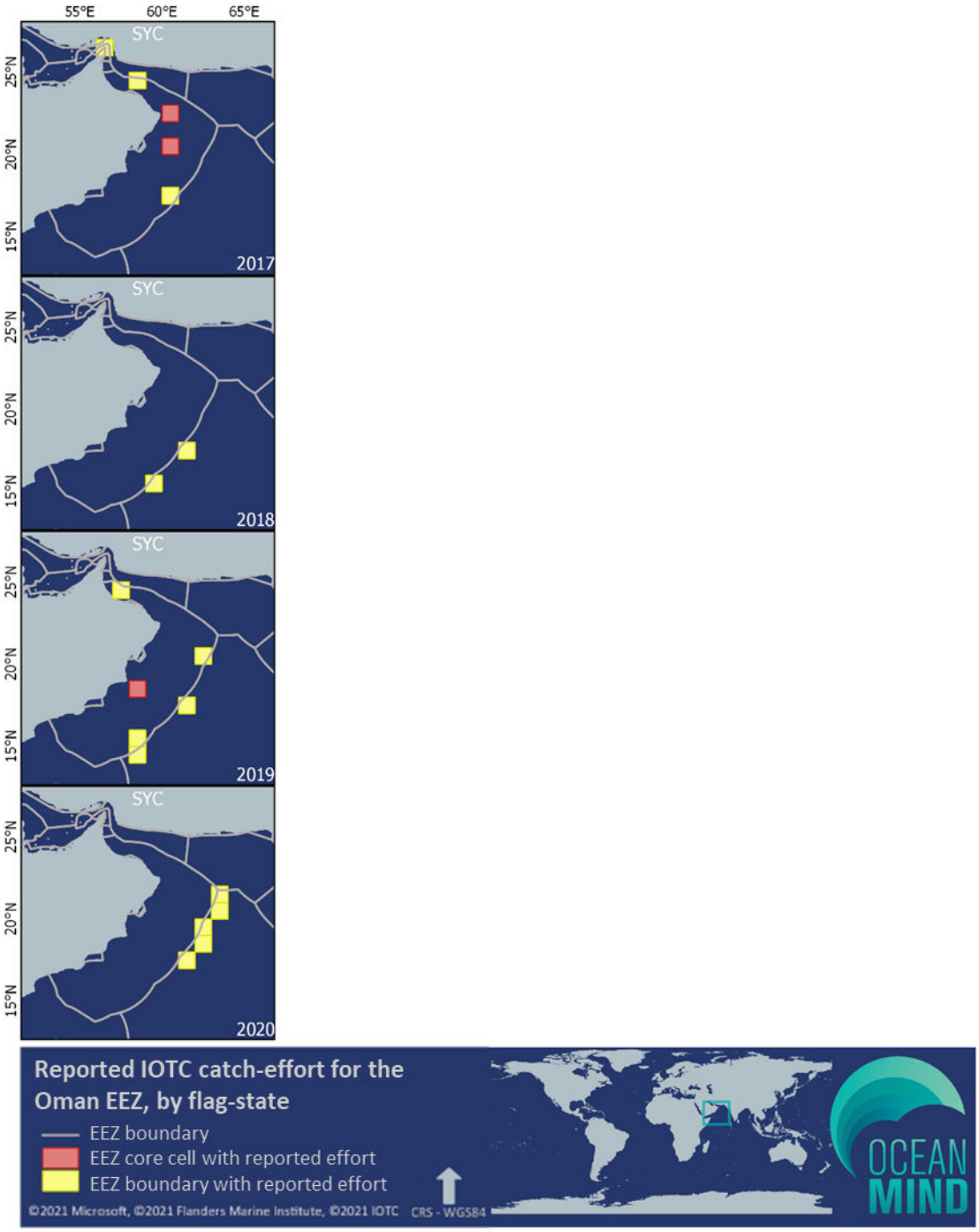


Figure 19: Location of SYC purse seine fishing effort associated with the Oman EEZ in 2017-2020

Table 10: Annual total effort (effort unit) and catch (metric tonnes) reported by purse seiners within and along the boundary of the Oman EEZ for the period 2016-2020

Year	2016						2017						2018						2019						2020					
Location	EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary		
Effort months	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M
	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J
	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S
	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D
Flag State *Reported effort* Total catch (metric tonnes)							**Seychelles** *24.7 FHOURS* 0 MT			**Mauritius** *1 SET* 55.69 MT **Seychelles** *24.7 FHOURS* 0 MT						**EU-Spain** *201.39 FHOURS* 1,964.33 MT **Seychelles** *27.56 FHOURS* 164.14 MT			**Seychelles** *12.74 FHOURS* 0 MT			**EU-Spain** *105.63 FHOURS* 395.41 MT **Seychelles** *58.24 FHOURS* 78.55 MT						**EU-Spain** *487.1 FHOURS* 1,947.01 MT **EU-France** *4 SETS* 117.56 MT **Mauritius** *1 SET* 11.3 MT **Seychelles** *127.4 FHOURS* 492.17 MT		

4.11 Islamic Republic of Pakistan

Catch-effort was reported by 3 flag-states in grid cells along the boundary of, the Pakistan EEZ for the period 2016-2020 (Figure 20). Catch-effort was reported by the fleets EUESP (2018-2020), MUS (2017), and SYC (2020) with all catch-effort being reported in grid cells along the Pakistan EEZ boundary (Table 11). Of note is the catch-effort reported by MUS in 2017, being a relatively high weight of 55.69 MT in a cell where >95% of the grid cell area is within the Pakistan EEZ. Although there is no clear indication that the reported catch was sourced from the Pakistan EEZ, the position of the cell dictates that the 55.69 MT was caught in either the Pakistan or Oman EEZ by MUS purse seiners in 2017.

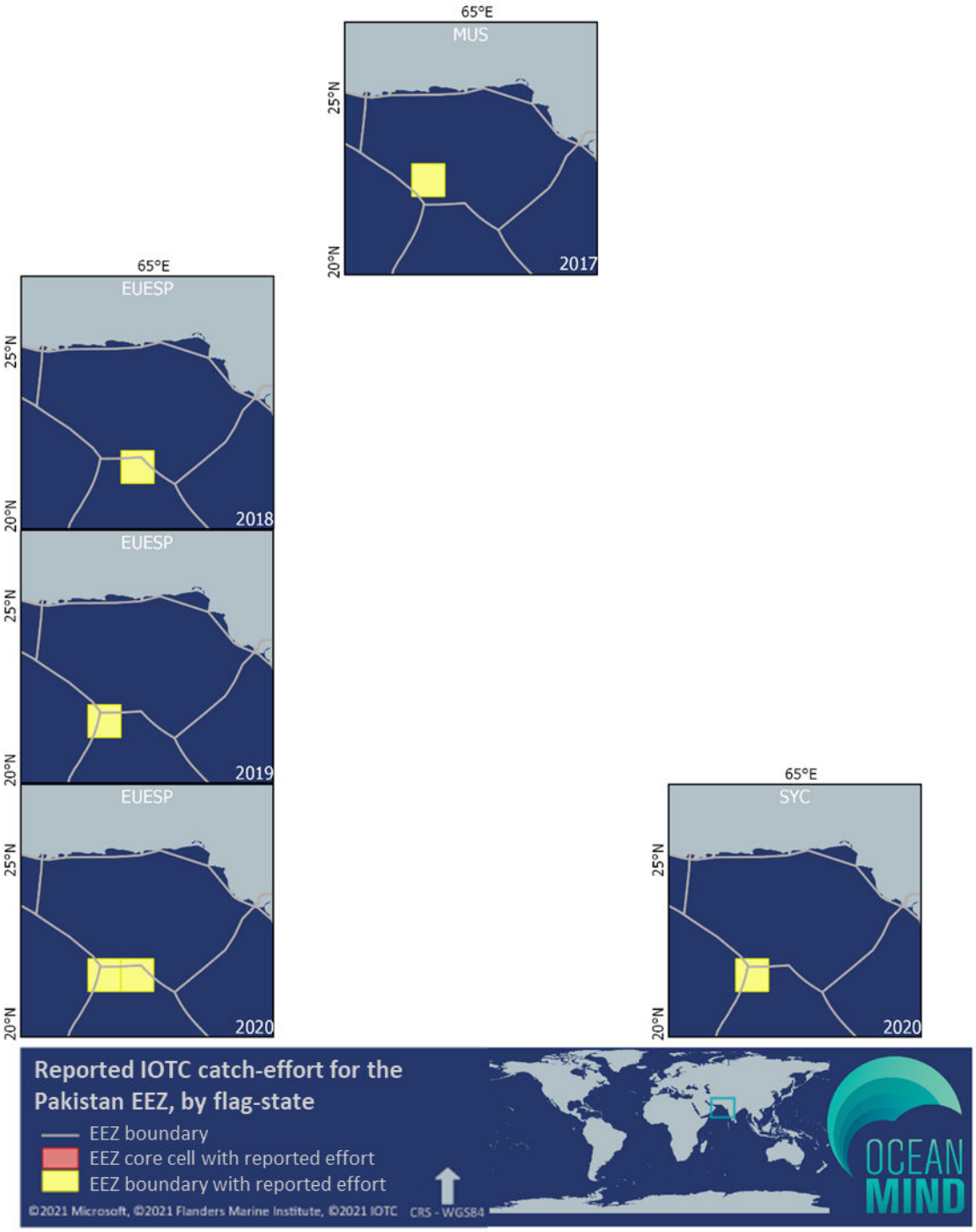


Figure 20: Location of EUESP, MUS and SYC purse seine fishing effort associated with the Pakistan EEZ in 2017-2020

Table 11: Annual total effort (effort unit) and catch (metric tonnes) reported by purse seiners within and along the boundary of the Pakistan EEZ for the period 2016-2020

Year	2016						2017						2018						2019						2020					
Location	EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary		
Effort months	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M
	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J
	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S
	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D
Flag State *Reported effort* Total catch (metric tonnes)										**Mauritius** *1 SETS* 55.69 MT						**EU-Spain** *5.36 FHOURS* 9.23 MT						**EU-Spain** *6.36 FHOURS* 77.24 MT						**EU-Spain** *32.73 FHOURS* 108.6 MT **Seychelles** *28.73 FHOURS* 60.29 MT					

4.12 Republic of Seychelles

Catch-effort was reported by 5 flag-states in grid cells within, or along the boundary of, the Seychelles EEZ for the period 2016-2020 (Figures 21-22). Catch-effort was reported by the fleets EUESP (2016-2020), EUFRA (2016-2020), KOR (2016-2020),MUS (2016-2020) and SYC (2016-2020). All flag-states reported catch-effort in grid cells both along the Seychelles EEZ boundary and inside the EEZ, including across all years. Catch-effort was distributed across the entire Seychelles EEZ and was reported for every month of the analysis period 2016-2020 (Table 12).

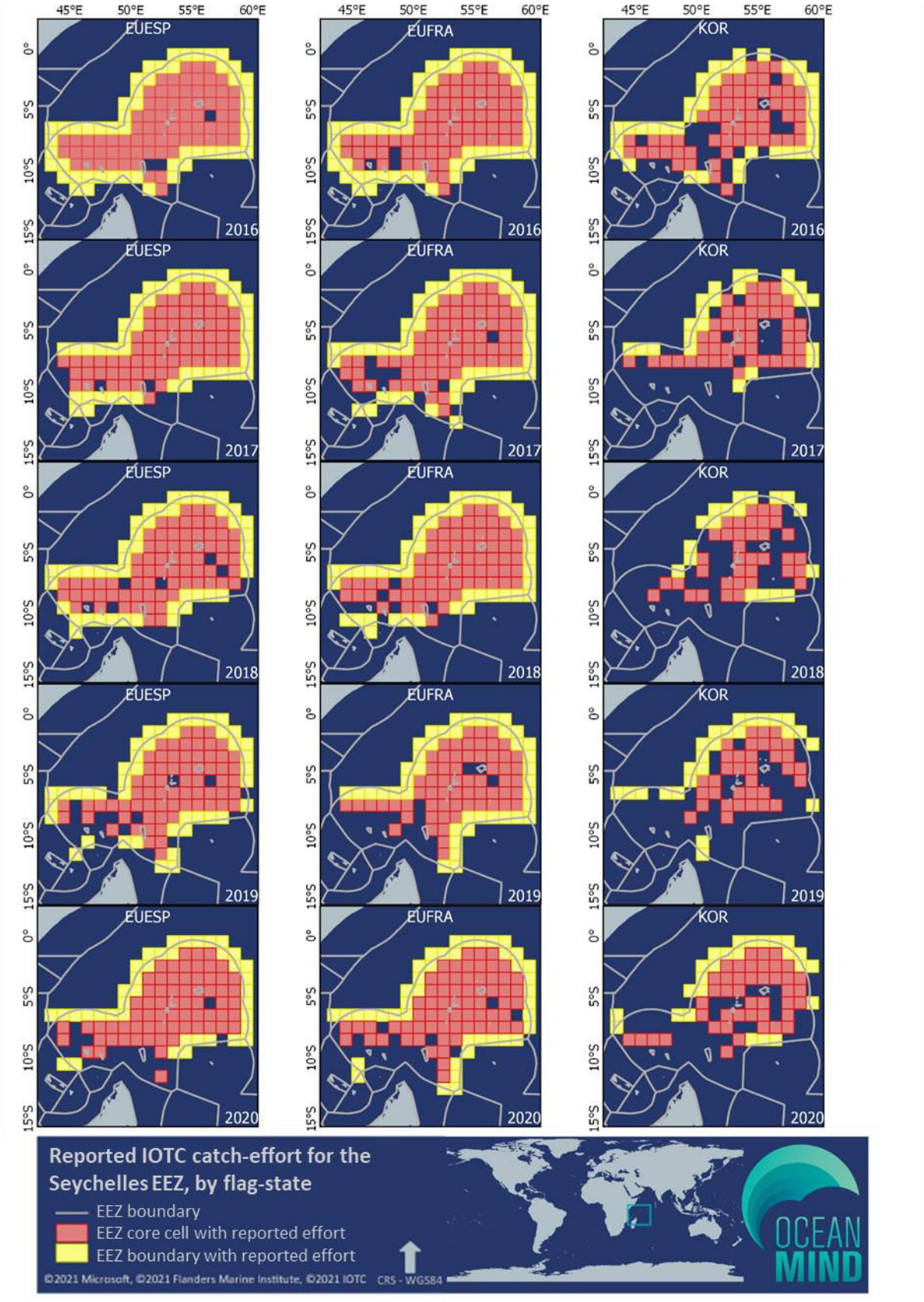


Figure 21: Location of EUESP, EUFRA and KOR purse seine fishing effort associated with the Seychelles EEZ in 2016-2020

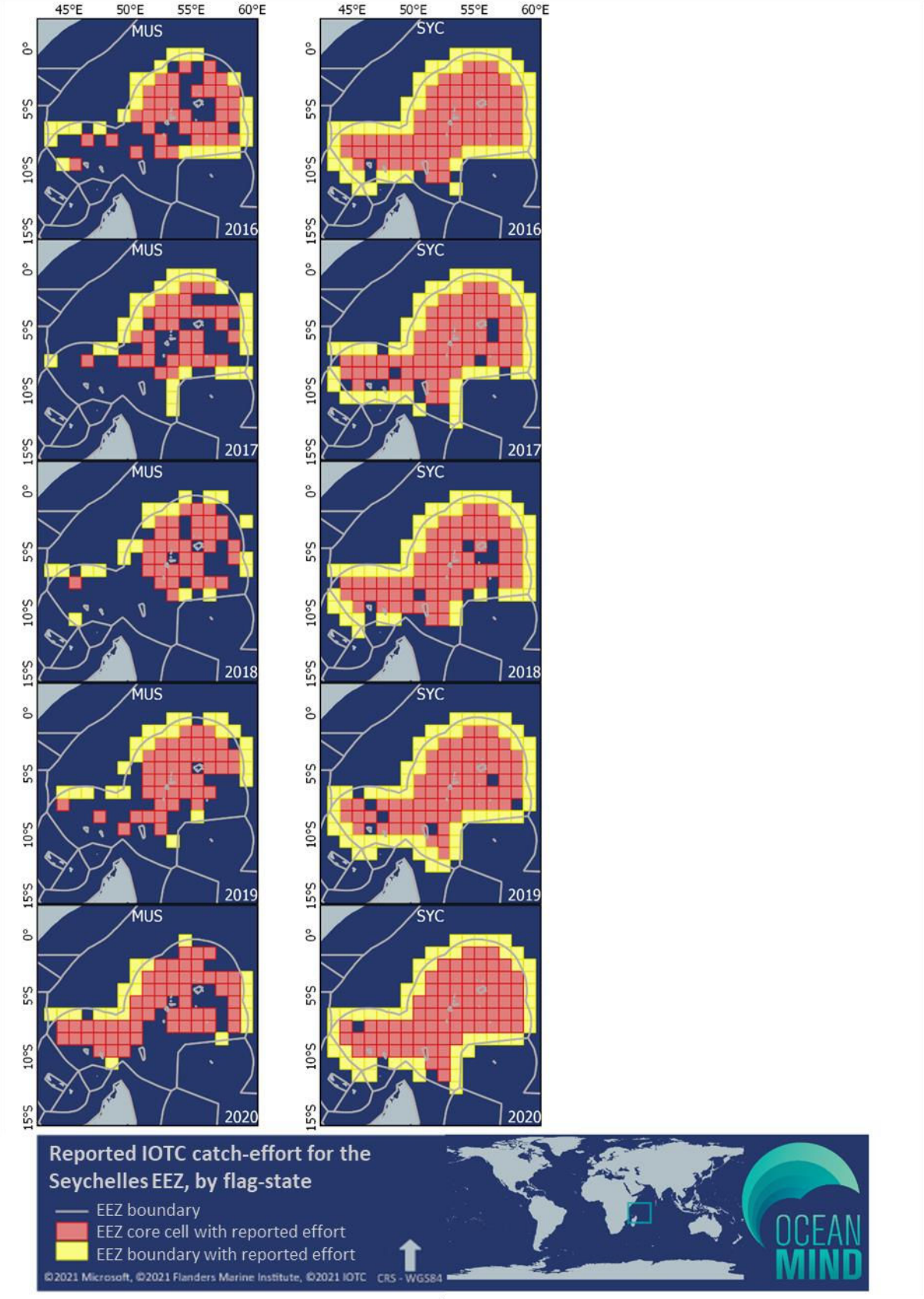


Figure 22: Location of MUS and SYC purse seine fishing effort associated with the Seychelles EEZ in 2016-2020

Table 12: Annual total effort (effort unit) and catch (metric tonnes) reported by purse seiners within and along the boundary of the Seychelles EEZ for the period 2016-2020

Year	2016						2017						2018						2019						2020					
Location	EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary		
Effort months	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M
	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J
	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S
	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D
Flag State *Reported effort* Total catch (metric tonnes)	**EU-Spain** *9,639.7 FHOURS* 19,829.85 MT **EU-France** *15,427.2 FHOURS* 23,223.29 MT **South Korea** *298 SETS* 5,432 MT **Mauritius** *145 SETS* 3,286.95 MT **Seychelles** *12,381.72 FHOURS* 14,679.33 MT			**EU-Spain** *7,844 FHOURS* 17,527.55 MT **EU-France** *7,261.2 FHOURS* 12,218.95 MT **South Korea** *144 SETS* 2,214 MT **Mauritius** *90 SETS* 2,284.23 MT **Seychelles** *8,322.08 FHOURS* 14,600.53 MT			**EU-Spain** *8,033.9 FHOURS* *11 HOURS* 19,134.21 MT **EU-France** *11,124 FHOURS* *72 HOURS* 17,433.14 MT **South Korea** *181 SETS* 3,637.42 MT **Mauritius** *147 SETS* 3,026.37 MT **Seychelles** *7,447.83 FHOURS* 12,182.67 MT			**EU-Spain** *3,606.9 FHOURS* 9,131.01 MT **EU-France** *5,073.9 FHOURS* *111 HOURS* 8,408.04 MT **South Korea** *77 SETS* 2,271.5 MT **Mauritius** *69 SETS* 1,534.48 MT **Seychelles** *3,875.82 FHOURS* 7,927.53 MT			**EU-Spain** *6,979.35 FHOURS* 23,952.06 MT **EU-France** *10,610.6 FHOURS* 18,605.92 MT **South Korea** *96 SETS* 2,961.02 MT **Mauritius** *154 SETS* 4,404.3 MT **Seychelles** *7,018.83 FHOURS* 19,659.31 MT			**EU-Spain** *4,748.92 FHOURS* 18,833.51 MT **EU-France** *5,071.3 FHOURS* 7,350.67 MT **South Korea** *43 SETS* 819 MT **Mauritius** *49 SETS* 1,946.56 MT **Seychelles** *3,468.66 FHOURS* 9,868.4 MT			**EU-Spain** *6,472.9 FHOURS* 18,726.49 MT **EU-France** *701 SETS* 19,482.83 MT **South Korea** *121 SETS* 2,841 MT **Mauritius** *248 SETS* 8,895.88 MT **Seychelles** *6,100.51 FHOURS* 12,181.16 MT			**EU-Spain** *5,084.35 FHOURS* 16,599.54 MT **EU-France** *249 SETS* 7,302.73 MT **South Korea** *139 SETS* 4,134 MT **Mauritius** *86 SETS* 3,294.28 MT **Seychelles** *4,597.19 FHOURS* 11,356.71 MT			**EU-Spain** *7,416.51 FHOURS* 24,538.64 MT **EU-France** *905 SETS* 23,977.07 MT **South Korea** *157 SETS* 2,485 MT **Mauritius** *287 SETS* 8,304.51 MT **Seychelles** *9,634.56 FHOURS* 19,800.31 MT			**EU-Spain** *4,461 FHOURS* 12,289.67 MT **EU-France** *238 SETS* 4,877.55 MT **South Korea** *62 SETS* 1,225 MT **Mauritius** *62 SETS* 1,804.62 MT **Seychelles** *5,139.42 FHOURS* 10,410.33 MT		

4.13 Federal Republic of Somalia

Catch-effort was reported by 5 flag-states in grid cells within, or along the boundary of, the Somalia EEZ for the period 2016-2020 (Figures 23-24). Catch-effort was reported by the fleets EUESP, EUFRA, KOR, MUS and SYC (all in the years 2016-2020). Catch-effort was reported in grid cells along the Somalia EEZ boundary in all months of every year for the period 2016-2020 (Table 13).

The flag-states EUESP, EUFRA, MUS and SYC all reported effort and catch-effort within grid cells inside the Somalia EEZ during the 2016-2020 period (Figures 23-34). No purse seine catch-effort was reported by any flag-state in 2016 inside the Somalia EEZ, although EUESP, EUFRA and MUS did report effort and catch-effort inside the EEZ in 2017 (Table 13). EUESP and EUFRA reported effort inside the Somalia EEZ in 2018, but did not in 2019 (SYC was the sole flag-state reporting purse seine catch-effort inside the EEZ in 2019). Only EUESP reported catch-effort from surface gears inside the Somalia EEZ in 2020.

Some EEZ grid cells were in close proximity to the Somalia coastline (such as those reported by EUFRA in 2018), thus it is possible that associated purse seiner activity included port calls or similar activity (Figures 23-24). This is further supported by low or zero catch weights reported, relative to other grid cells positioned further away from the coast (Table 13).

Analysis of catch-effort reported by flag-states in the maritime territory disputed between Somalia and Kenya is presented separately from these coastal states (Section 4.14).

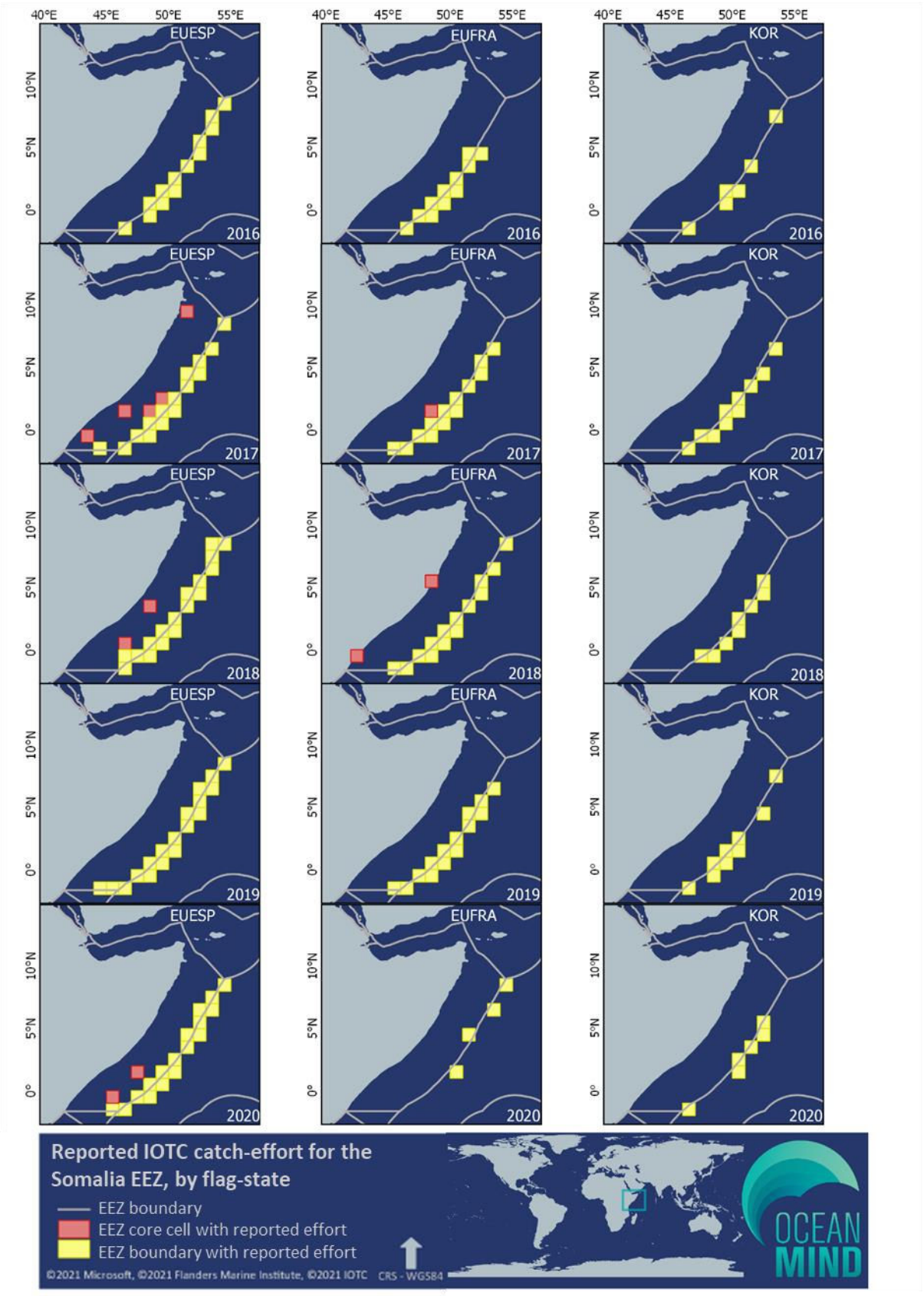


Figure 23: Location of EUESP, EUFRA and KOR purse seine fishing effort associated with the Somalia EEZ in 2016-2020

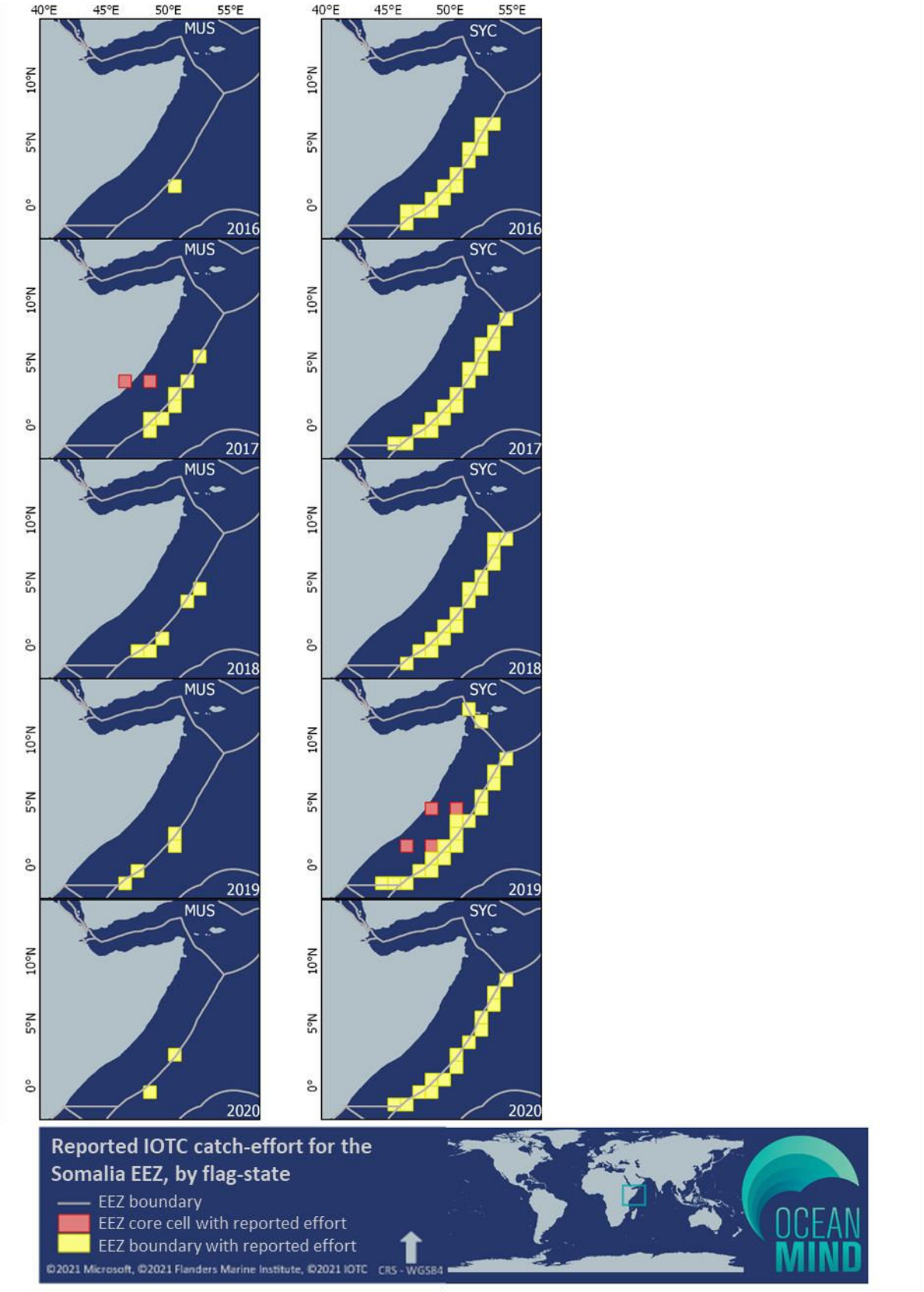


Figure 24: Location of MUS and SYC purse seine fishing effort associated with the Somalia EEZ in 2016-2020

Table 13: Annual total effort (effort unit) and catch (metric tonnes) reported by purse seiners within and along the boundary of the Somalia EEZ for the period 2016-2020

Year	2016						2017						2018						2019						2020					
Location	EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary		
Effort months	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M
	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J
	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S
	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D
Flag State *Reported effort* Total catch (metric tonnes)				**EU-Spain** *1,409.9 FHOURS* 5,035.06 MT **EU-France** *625.4 FHOURS* 1,793.84 MT **South Korea** *10 SETS* 215 MT **Mauritius** *1 SET* 35.78 MT **Seychelles** *1,917.89 FHOURS* 5,151.29 MT			**EU-Spain** *54.7 FHOURS* 239.36 MT **EU-France** *12.1 FHOURS* 0 MT **Mauritius** *7 SETS* 16.69 MT			**EU-Spain** *2,705.3 FHOURS* 13,428.65 MT **EU-France** *926.7 FHOURS* *24 HOURS* 1,656.01 MT **South Korea** *31 SETS* 840.38 MT **Mauritius** *26 SETS* 762 MT **Seychelles** *2,868.84 FHOURS* 11,733.52 MT			**EU-Spain** *10.08 FHOURS* 94.55 MT **EU-France** *24.31 FHOURS* 0 MT			**EU-Spain** *3,480.15 FHOURS* 22,601.26 MT **EU-France** *518.57 FHOURS* 1,479.28 MT **South Korea** *22 SETS* 716 MT **Mauritius** *12 SETS* 367.99 MT **Seychelles** *2,383.55 FHOURS* 11,173.47 MT			**Seychelles** *32.76 FHOURS* 85.89 MT			**EU-Spain** *2,500.61 FHOURS* 13,978.79 MT **EU-France** *142 SETS* 4,073.14 MT **South Korea** *32 SETS* 507 MT **Mauritius** *12 SETS* 693.76 MT **Seychelles** *1,781.26 FHOURS* 5,964.49 MT			**EU-Spain** *18.14 FHOURS* 20.19 MT			**EU-Spain** *1,020.41 FHOURS* 3,581.45 MT **EU-France** *6 SETS* 60.1 MT **South Korea** *9 SETS* 305 MT **Mauritius** *2 SETS* 74.6 MT **Seychelles** *771.16 FHOURS* 1,811.08 MT		

4.14 Somalia-Kenya disputed maritime zone

No EEZ grid cells were available for the disputed maritime territory between Kenya and Somalia, all associated grid cells being along the boundary of the feature.

Catch-effort was reported by 5 flag-states in grid cells along the boundary of the Somalia-Kenya disputed maritime territory EEZ for the period 2016-2020 (Figures 25-26). Catch-effort was reported by the fleets EUESP (2016-2020), EUFRA (2016-2020), KOR (2016-2020), MUS (2017-2020) and SYC (2016-2020). Catch-effort was reported in grid cells along the boundary in most months of each year for the period 2016-2019, with a slight decrease in 2020 (Table 14).

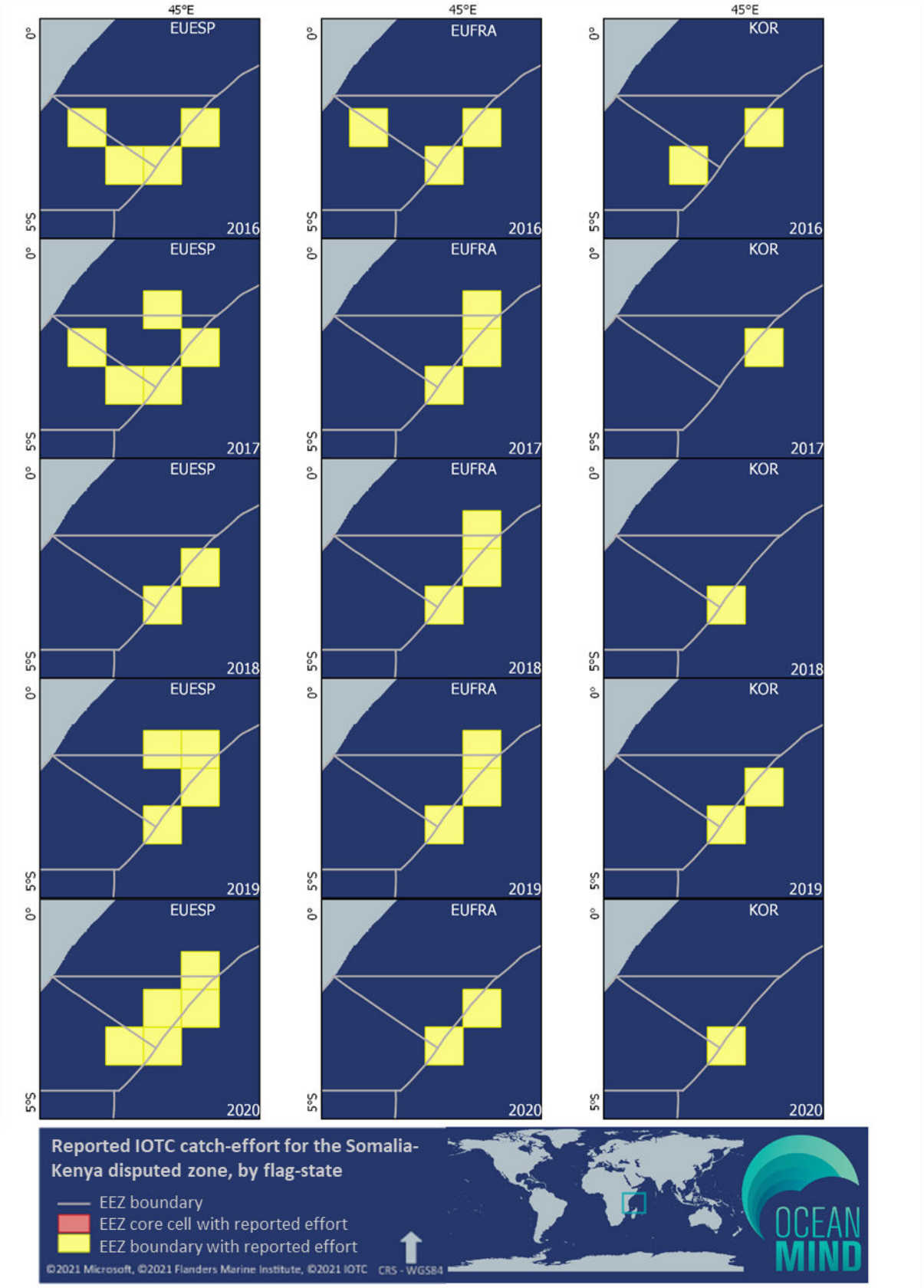


Figure 25: Location of EUESP, EUFRA and KOR purse seine fishing effort associated with the Somalia-Kenya disputed maritime territory in 2016-2020

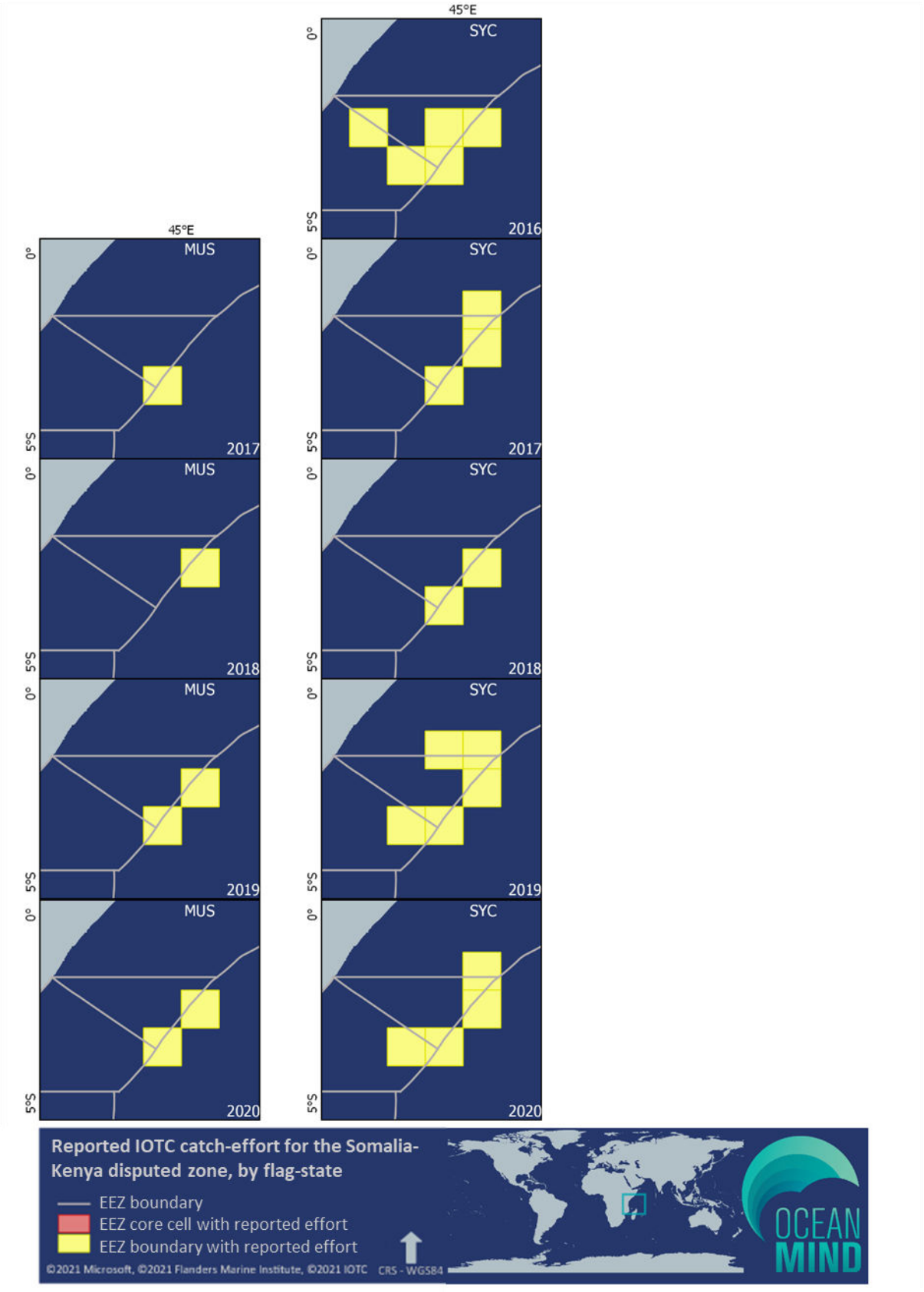


Figure 26: Location of MUS and SYC purse seine fishing effort associated with the Somalia-Kenya disputed maritime territory in 2016-2020

Table 14: Annual total effort (effort unit) and catch (metric tonnes) reported by purse seiners within and along the boundary of the Somalia-Kenya disputed maritime territory for the period 2016-2020

Year	2016						2017						2018						2019						2020					
Location	EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary		
Effort months	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M
	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J
	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S
	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D
Flag State *Reported effort* Total catch (metric tonnes)				**EU-Spain** *272.4 FHOURS* 617.45 MT **EU-France** *80 FHOURS* 67.3 MT **South Korea** *2 SETS* 43 MT **Seychelles** *304.33 FHOURS* 1,040.65 MT						**EU-Spain** *151.5 FHOURS* 1,314.58 MT **EU-France** *101.5 FHOURS* 163.21 MT **South Korea** *3 SETS* 110.22 MT **Mauritius** *1 SETS* 16.04 MT **Seychelles** *169.52 FHOURS* 653.12 MT						**EU-Spain** *211.86 FHOURS* 1,424.76 MT **EU-France** *140.01 FHOURS* 194.18 MT **South Korea** *1 SETS* 10 MT **Mauritius** *2 SETS* 93.32 MT **Seychelles** *117.65 FHOURS* 539.55 MT						**EU-Spain** *385.45 FHOURS* 1,501.96 MT **EU-France** *31 SETS* 696.42 MT **South Korea** *6 SETS* 195 MT **Mauritius** *2 SETS* 52.62 MT **Seychelles** *250.51 FHOURS* 936.75 MT						**EU-Spain** *560 FHOURS* 1,651.08 MT **EU-France** *7 SETS* 75.75 MT **South Korea** *1 SETS* 50 MT **Mauritius** *4 SETS* 74.65 MT **Seychelles** *146.9 FHOURS* 79.42 MT			

4.15 Republic of South Africa

Effort was reported by 1 flag-state in grid cells within the South Africa EEZ for the period 2016-2020 (Figure 27). Effort was reported in a single grid cell within the South Africa EEZ in January 2018 by SYC (Table 15). This grid cell was reported with very low effort (zero catch weight) and was in proximity to the port of Durban. Therefore, it is possible that the reported catch-effort was associated with a port call or similar activity.

Figure 27: Location of SYC purse seine fishing effort associated with the South Africa EEZ in 2018

Table 15: Annual total effort (effort unit) and catch (metric tonnes) reported by purse seiners within and along the boundary of the South Africa EEZ for the period 2016-2020

Year	2016						2017						2018						2019						2020					
Location	EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary		
Effort months	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M
	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J
	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S
	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D
Flag State *Reported effort* Total catch (metric tonnes)													**Seychelles** *2.34 FHOURS* 0 MT																	

4.16 United Republic of Tanzania

Catch-effort was reported by 5 flag-states in grid cells within, or along the boundary of, the Tanzania EEZ for the period 2016-2020 (Figures 28-29). Catch-effort was reported by the fleets EUESP (2016-2020), EUFRA (2016-2018, 2020), KOR (2016-2017, 2019-2020), MUS (2016-2018, 2020) and SYC (2016-2020). Catch-effort was reported in grid cells within the Tanzania EEZ by all 5 flag-states in 2016. However, only EUFRA reported effort within the EEZ in February and March 2018 (Table 16), in grid cells along the coastline and so this reported activity may have been associated with port calls. SYC reported catch-effort from a grid cell within the EEZ in 2019, close to the high-seas boundary (Figure 29). EUESP and SYC again reported effort in grid cells within the Tanzania EEZ in 2020 (Figure 28-29). However, there may be some disparity in catch-effort reported within the Tanzania EEZ by some fleets in some years. For example, SYC reported 65.39 FHOURS of effort within the Tanzania EEZ in 2020, associated with 0 MT of catch. As one of the grid cells in which SYC reported effort in 2020 was in proximity to coastal urban centres, it is possible that port activity was reported erroneously as fishing activity. However, activity was also reported by SYC in offshore grid cells within the Tanzania EEZ and so potential disparity between effort and catch may also be present in these cells.

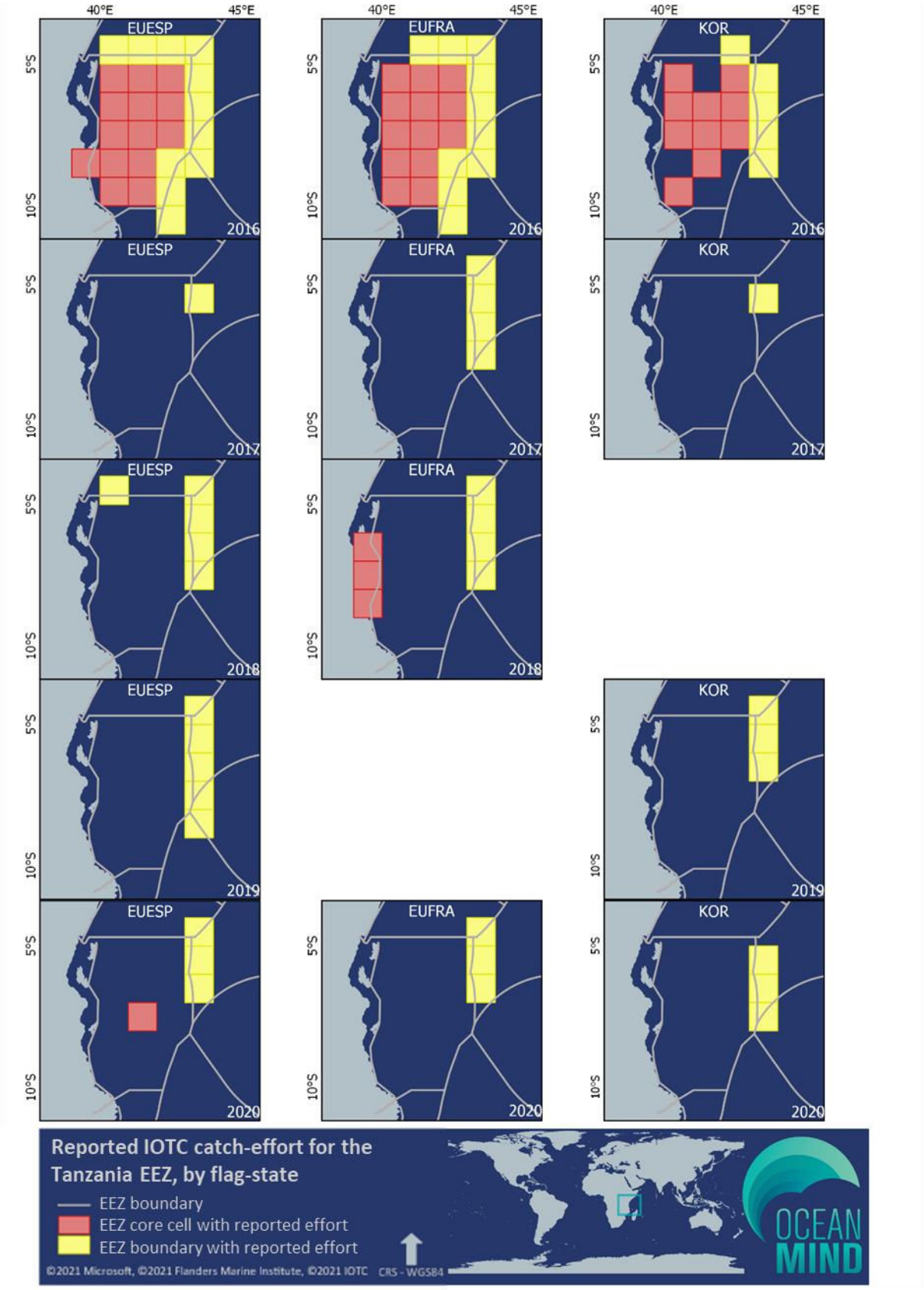


Figure 28: Location of EUESP, EUFRA and KOR purse seine fishing effort associated with the Tanzania EEZ in 2016-2020

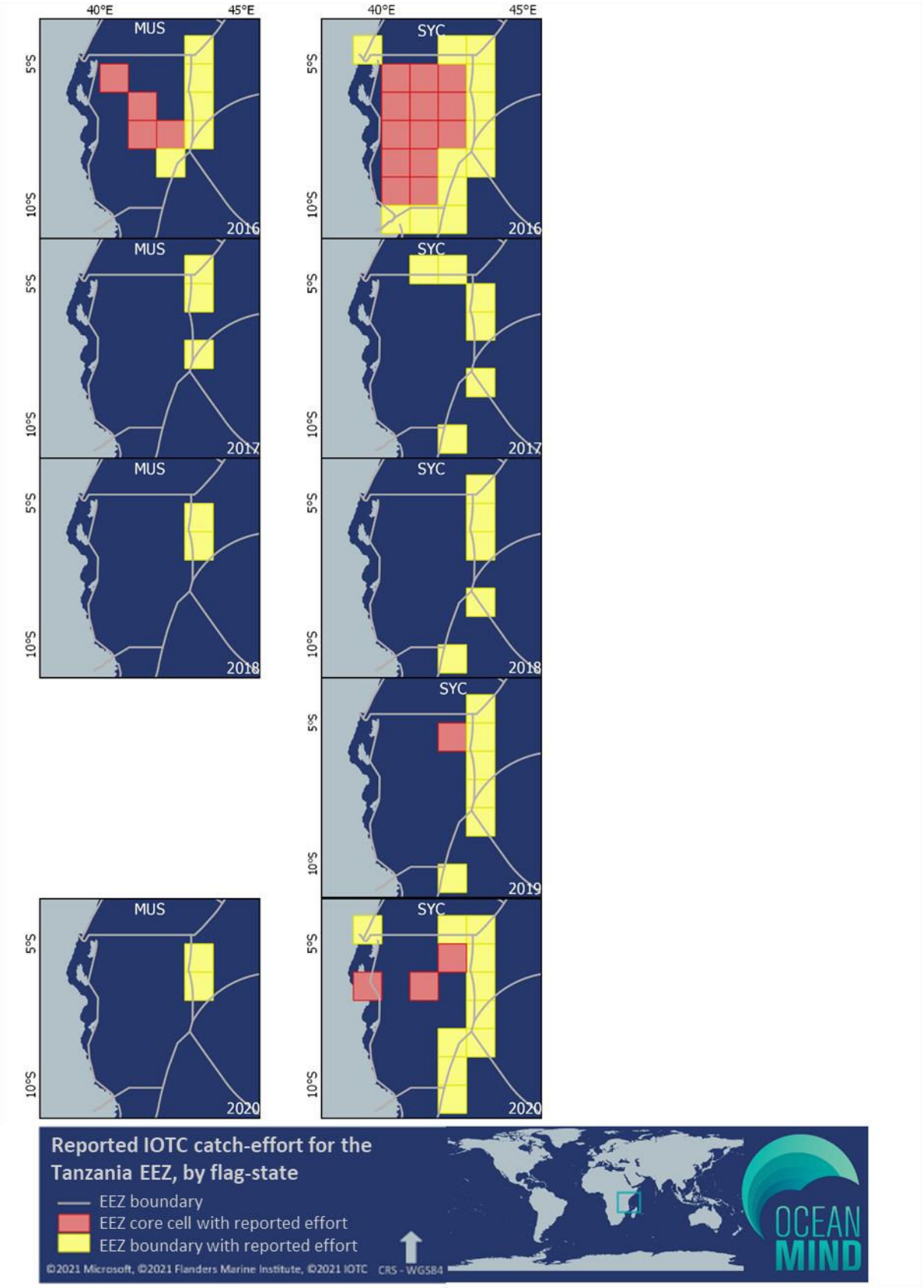


Figure 29: Location of MUS and SYC purse seine fishing effort associated with the Tanzania EEZ in 2016-2020

Table 16: Annual total effort (effort unit) and catch (metric tonnes) reported by purse seiners within and along the boundary of the Tanzania EEZ for the period 2016-2020

Year	2016						2017						2018						2019						2020					
Location	EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary		
Effort months	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M
	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J
	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S
	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D
Flag State *Reported effort* Total catch (metric tonnes)	**EU-Spain** *673.3 FHOURS* 2,139.83 MT **EU-France** *558.3 FHOURS* 1,045.44 MT **South Korea** *60 SETS* 1,116 MT **Mauritius** *15 SETS* 408.25 MT **Seychelles** *600.08 FHOURS* 1,425.4 MT			**EU-Spain** *1,261.2 FHOURS* 4,544.74 MT **EU-France** *923.9 FHOURS* 1,468.8 MT **South Korea** *23 SETS* 413 MT **Mauritius** *20 SETS* 323.09 MT **Seychelles** *1,241.11 FHOURS* 2,760.84 MT						**EU-Spain** *23.8 FHOURS* 13.13 MT **EU-France** *72.5 FHOURS* 55.87 MT **South Korea** *1 SETS* 95.02 MT **Mauritius** *8 SETS* 113.2 MT **Seychelles** *184.21 FHOURS* 1,056.17 MT			**EU-France** *49.14 FHOURS* 0 MT			**EU-Spain** *278.1 FHOURS* 1,580.2 MT **EU-France** *138.45 FHOURS* 81.21 MT **Mauritius** *14 SETS* 671.33 MT **Seychelles** *230.49 FHOURS* 494.75 MT			**Seychelles** *13.39 FHOURS* 56.41 MT			**EU-Spain** *284.52 FHOURS* 1,852.42 MT **South Korea** *5 SETS* 190 MT **Seychelles** *144.04 FHOURS* 333.13 MT			**EU-Spain** *11.71 FHOURS* 0 MT **Seychelles** *65.39 FHOURS* 0 MT			**EU-Spain** *221.97 FHOURS* 586.07 MT **EU-France** *7 SETS* 60.01 MT **South Korea** *9 SETS* 155 MT **Mauritius** *5 SETS* 137.52 MT **Seychelles** *377 FHOURS* 645.79 MT		

4.17 United Arab Emirates

Only SYC reported effort from grid cells along the United Arab Emirates EEZ boundary, this being in February 2017 (Figure 30, Table 17). These grid cells were at the confluence of several coastal-state EEZs, and along the coastline of at least two nations. Therefore, given the low effort reported (Table 17), it is possible that this declared effort by SYC was associated with port calls or similar activities.

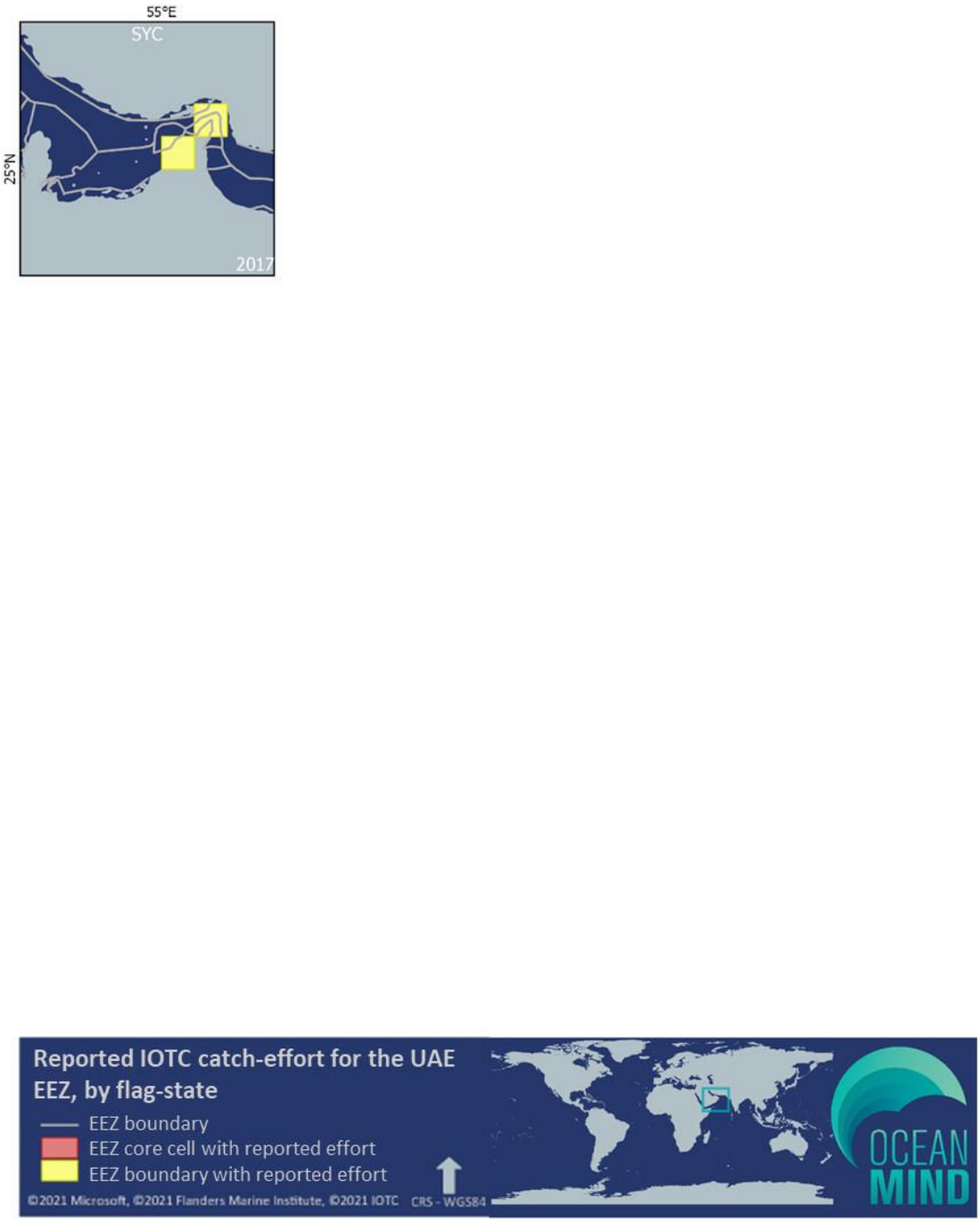


Figure 30: Location of SYC purse seine fishing effort associated with the United Arab Emirates EEZ in 2017

Table 17: Annual total effort (effort unit) and catch (metric tonnes) reported by purse seiners within and along the boundary of the UAE EEZ for the period 2016-2020

Year	2016						2017						2018						2019						2020					
Location	EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary		
Effort months	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M
	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J
	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S
	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D
Flag State *Reported effort* Total catch (metric tonnes)										**Seychelles** *25.35 FHOURS* 0 MT																				

4.18 Republic of Yemen

Catch-effort was reported by 5 flag-states in grid cells within, or along the boundary of, the Yemen EEZ for the period 2016-2020 (Figures 31-32). Catch-effort was reported by the fleets EUESP (2016-2020), EUFRA (2017-2018, 2020), KOR (2020), MUS (2017) and SYC (2017-2020). Catch-effort was only reported in grid cells within the Yemen EEZ by MUS, this being in March 2017 (Table 18). As shown in Figures 31 and 32, most catch-effort was reported in grid cells along the Yemen EEZ and high-seas boundary, although there was catch-effort reported along the boundary with the Somalia EEZ reported by SYC in 2019 (Figure 32).

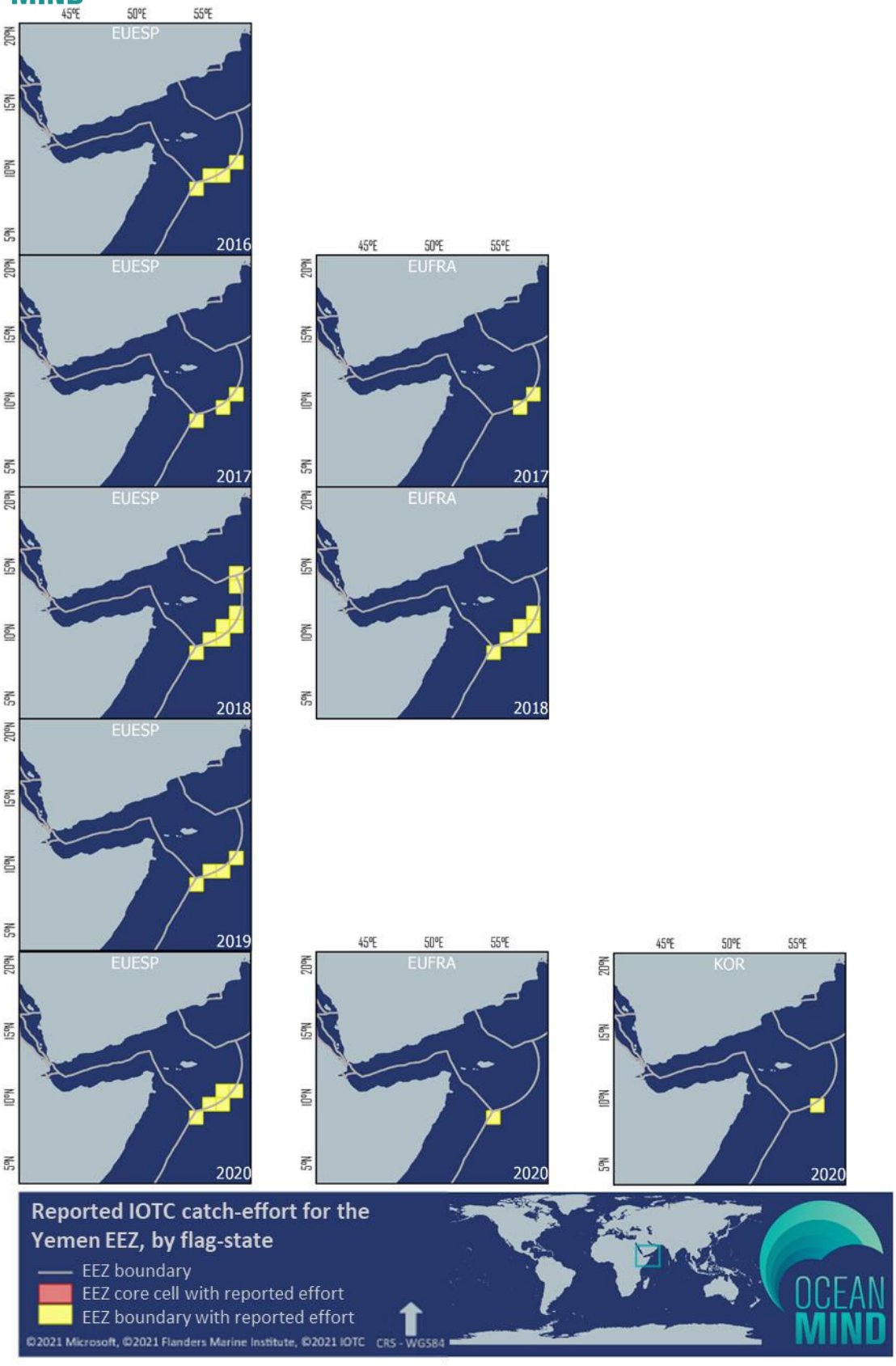


Figure 31: Location of EUESP, EUFRA and KOR purse seine fishing effort associated with the Yemen EEZ in 2016-2020

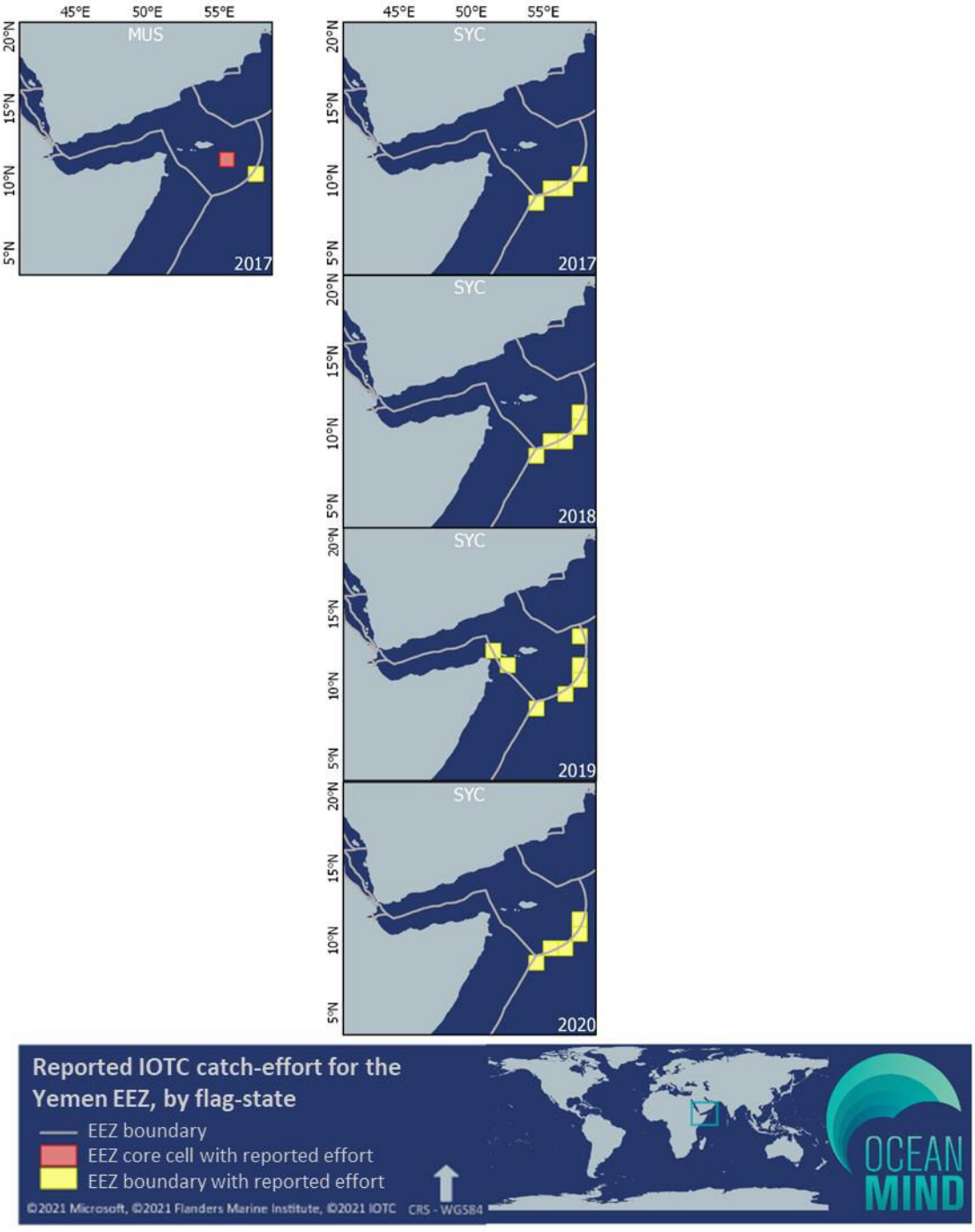


Figure 32: Location of MUS and SYC purse seine fishing effort associated with the Yemen EEZ in 2017-2020

Table 18: Annual total effort (effort unit) and catch (metric tonnes) reported by purse seiners within and along the boundary of the Yemen EEZ for the period 2016-2020

Year	2016						2017						2018						2019						2020					
Location	EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary		
Effort months	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M
	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J
	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S
	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D
Flag State *Reported effort* Total catch (metric tonnes)				**EU-Spain** *71.4 FHOURS* 61.5 MT			**Mauritius** *2 SETS* 109.53 MT			**EU-Spain** *54.6 HOURS* 59.62 MT **EU-France** *35.7 FHOURS* 33.61 MT **Mauritius** *2 SETS* 28.4 MT **Seychelles** *112.45 FHOURS* 437.4 MT						**EU-Spain** *789.97 FHOURS* 5,117.93 MT **EU-France** *123.89 FHOURS* 350.6 MT **Seychelles** *143 FHOURS* 952.43 MT						**EU-Spain** *65.22 FHOURS* 325.77 MT **Seychelles** *100.1 FHOURS* 496.89 MT						**EU-Spain** *104.7 FHOURS* 178.7 MT **EU-France** *1 SETS* 24.23 MT **South Korea** *1 SETS* 30 MT **Seychelles** *166.01 FHOURS* 458.88 MT		

5 Purse seine transmission on AIS

5.1 EU-Spain

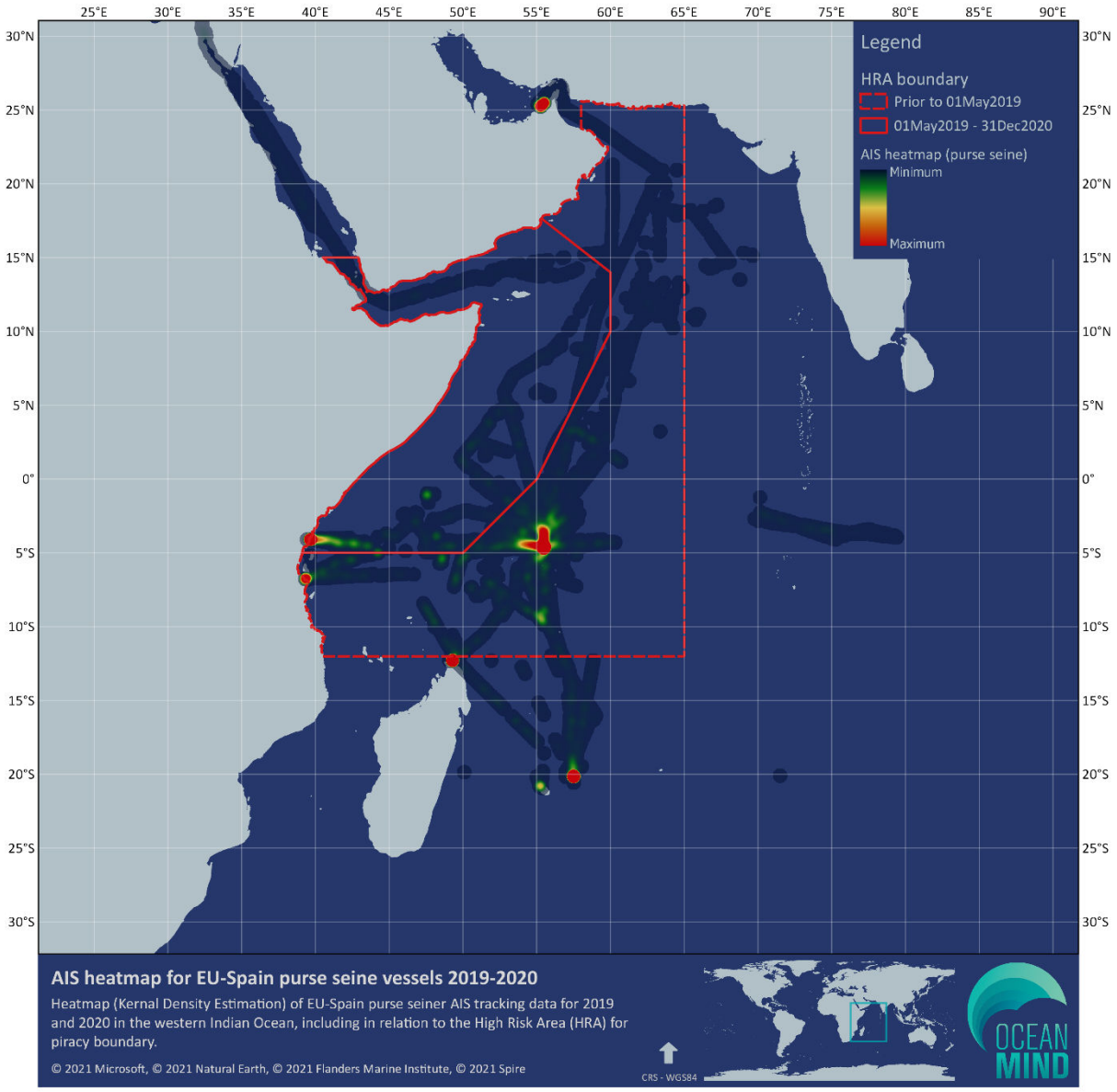


Figure 33: Heatmap of AIS transmissions from the EUESP purse seine fleet in the AOI, 2019-2020

The 14 EU-Spain flagged purse seine vessels included in this analysis showed varied levels and patterns of AIS transmission (Table 19). Kernal Density Estimation of AIS transmissions by the EUESP fleet indicated generally highest use in and around ports (e.g. Port Victoria) and during transits (e.g. turning AIS on to transit the Chagos Archipelago EEZ), but very low levels on the high seas and during likely fishing operations (Figure 33).

On average, the EUESP flagged purse seine vessels only transmitted on AIS on 26.5% of days over the 731-day analysis period[2] between 01Jan2019 and 31Dec2020. There was considerable variability in the number of AIS transmission days outside of port between vessels, varying between 185 days (64.7% of transmission days) and 48 days (21.5% of transmission days). The lowest transmission outside of port was observed to be the purse seiners ALBACAN (26.1% outside of port) and only transmitting 28.3% of possible days, and ALBACORA UNO (21.5% outside port) and only transmitting 30.5% of possible days, during the 2019-2020 analysis period (Table 19). The generally low levels of AIS transmission in the EUESP purse seine fleet coupled with the observed locations of the vessels cannot be wholly explained by the vessels turning off AIS due to the risk of piracy.

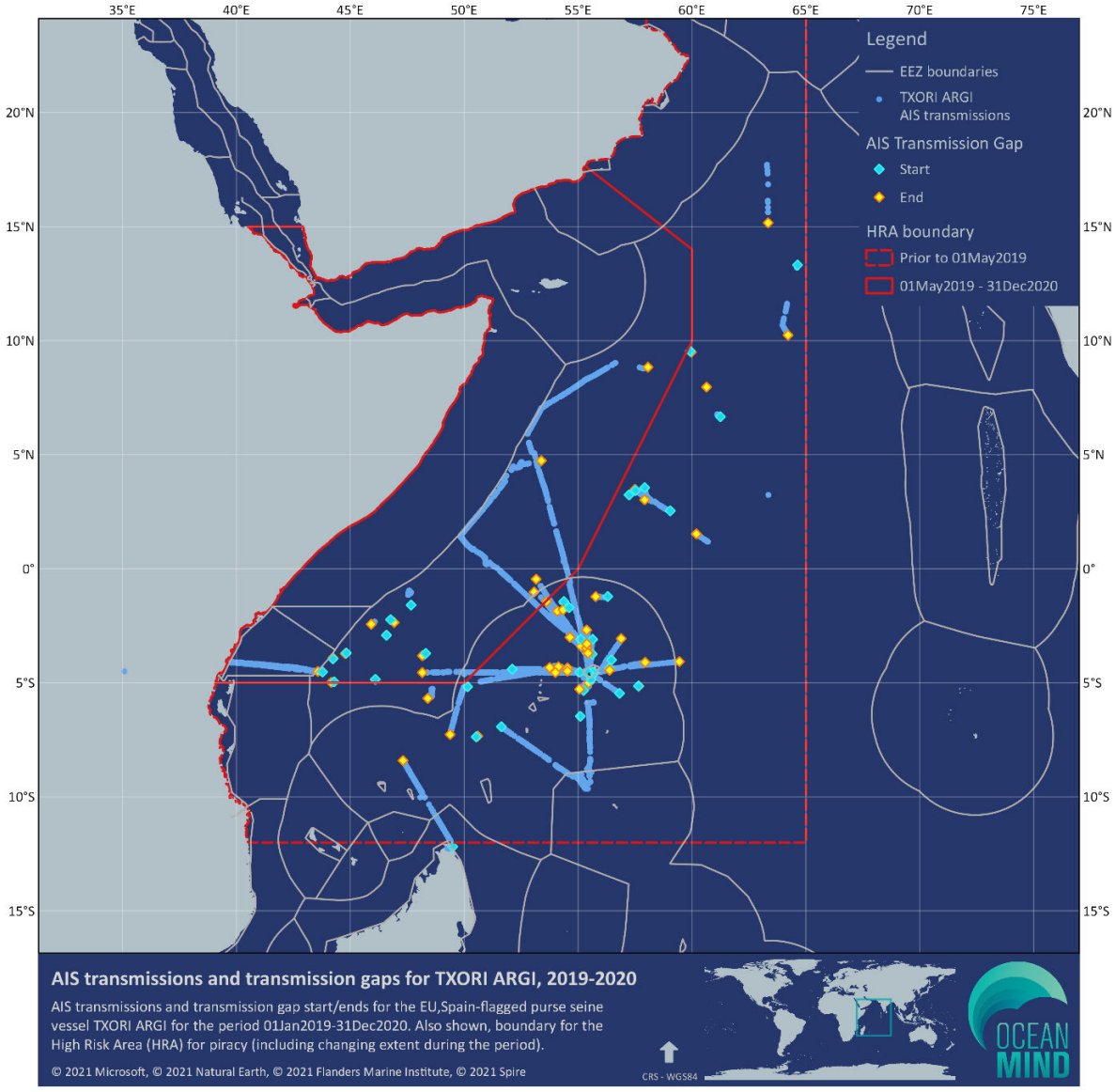


Figure 34: AIS transmissions in 2019 for the EUESP purse seine vessel TXORI ARGI

[2] Note 513 days for ATERPE ALAI due to entry into the IOTC area on 07Aug2019 by this vessel

As shown in Figure 34 and Table 19, the vessel TXORI ARGI exhibited a higher number of AIS transmission days (39.1%) than average for the EUESP fleet, and 64.7% of transmission days were outside of port. However, as shown by Figure 34, TXORI ARGI stopped transmitting multiple times during the 2019 analysis period, often within the Seychelles EEZ. This may suggest that although TXORI ARGI did transmit outside of port, transmissions ceased at some point during transit from port to fishing area as the vessel shows few transmission tracks that indicate behaviour linked to fishing.

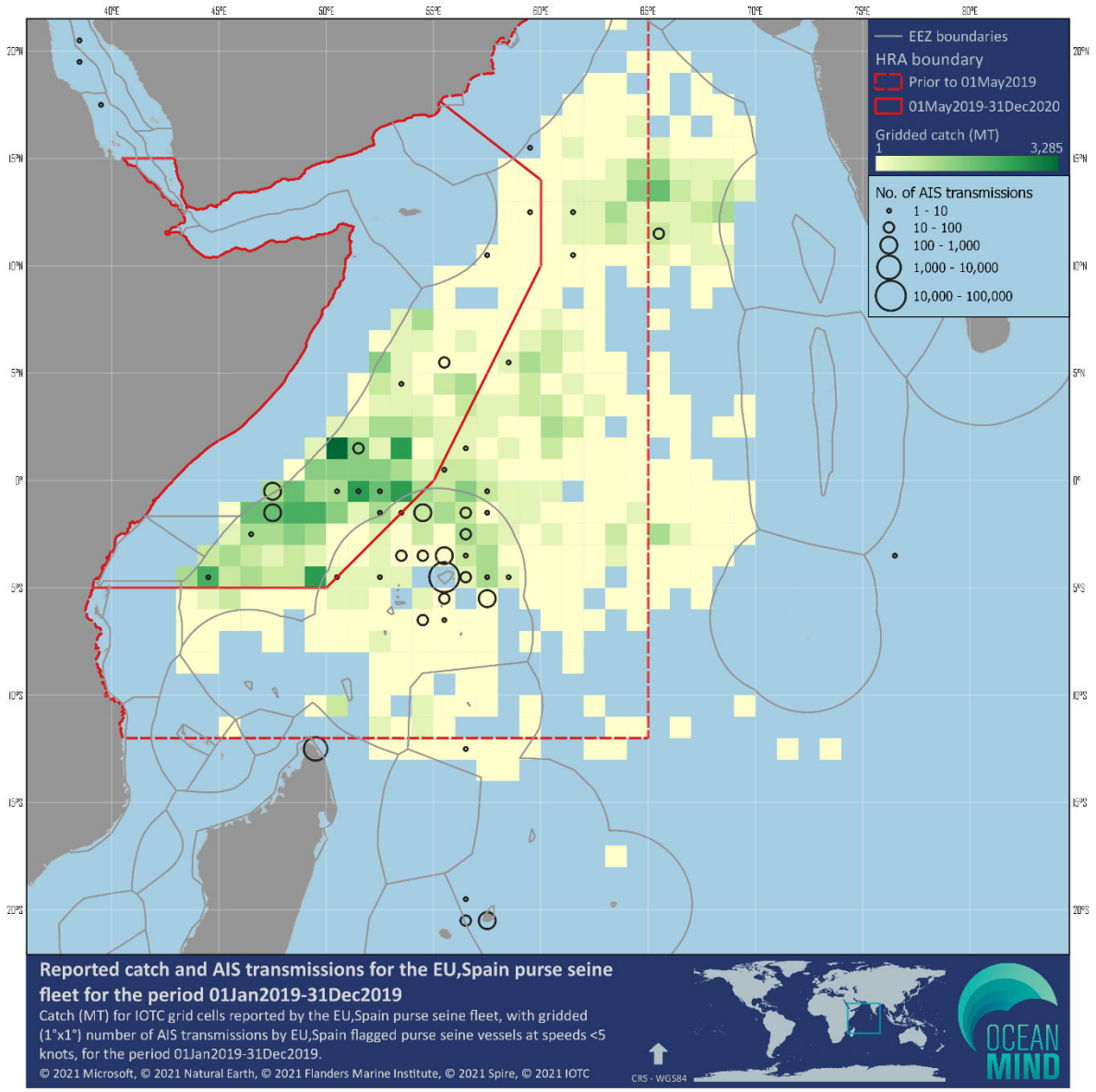


Figure 35: Gridded catch (MT) and AIS transmissions at speed <5 knots for EUESP purse seiners, 2019

The apparent low transmission on AIS from the EUESP fleet when outside of port or engaging in fishing operations is further indicated by Figure 35. Figure 35 illustrates that many of the grid cells with highest catch weights (MT) reported by the EUESP purse seine fleet in 2019 do not contain any AIS transmissions from the same fleet. As shown in Figure 35, only 39 of the 450 total grid cells where

catch-effort was reported by the EUESP purse seine fleet in 2019 contained any AIS transmissions. These 39 grid cells with both reported catch-effort and AIS transmissions at slow-speeds represented 16.7% of total catch by EUESP in 2019, suggesting very low use of AIS during fishing operations. Many of these grid cells lay outside of the HRA for piracy and also include grid cells inside of coastal state EEZs, and along EEZ boundaries such as Somalia, Yemen and India.

Table 19: AIS usage by EUESP-flagged purse seine vessels in the western Indian Ocean AOI 01Jan2019-31Dec2020.

Vessel name	MMSI	IRCS	Longest AIS transmission gap	AIS transmission days	AIS transmission days as percentage of total	AIS transmission days outside of port	Percentage of transmission days outside port	Number of AIS transmissions within HRA*
ALAKRANA	224702000	ECKG	2 mon, 12 days, 2 hrs, 9 min	164	22.4	56	34.1	673
ALBACAN	224469000	EACO	3 mon, 6 days, 21 hrs, 45 min	207	28.3	54	26.1	24,961
ALBACORA CUATRO	224755000	EALM	9 mon, 28 days, 9 hrs, 43 min	142	19.4	124	87.3	2,159
ALBACORA UNO	224782000	EAMB	3 mon, 28 days, 23 hrs, 57 min	223	30.5	48	21.5	536
ALBATUN DOS	224088000	ECEM	1 mon, 7 days, 7 hrs, 52 min	237	32.4	115	48.5	742
ATERPE ALAI†	224774000	EAMT	4 mon, 21 days, 8 hrs, 52 min	173	33.7	89	51.4	3,297
DONIENE	224464000	EAAI	3 mon, 0 days, 22 hrs, 57 min	185	25.3	120	64.9	1,857
ELAI ALAI	224716000	EAIW	2 mon, 3 days, 21 hrs, 12 min	158	21.6	74	46.8	1,086
ITSAS TXORI	225455000	EAHO	4 mon, 15 days, 22 hrs, 15 min	104	14.2	55	52.9	5,199
IZURDIA	224698000	ECGM	3 mon, 1 days, 10 hrs, 21 min	199	27.2	87	43.7	1,383
PLAYA DE ARITZATXU	224922000	EBVR	1 mon, 12 days, 3 hrs, 33 min	242	33.1	112	46.3	123
TXORI ARGI	224103000	ECEQ	1 mon, 0 days, 10 hrs, 43 min	286	39.1	185	64.7	12,930
TXORI GORRI	225375000	ECNP	1 mon, 6 days, 20 hrs, 1 min	172	23.5	70	40.7	1
TXORI ZURI	225309000	EABO	2 mon, 9 days, 12 hrs, 27 min	145	19.8	70	48.3	329

**HRA boundary as of 01May2019*

† ATERPE ALAI was built in July 2019, entering the IOTC area on 07Aug2019, with the potential transmission period for 2019-2020 being adjusted to 513 days (07Aug2019-31Dec2020) for this vessel.

5.2 EU-France

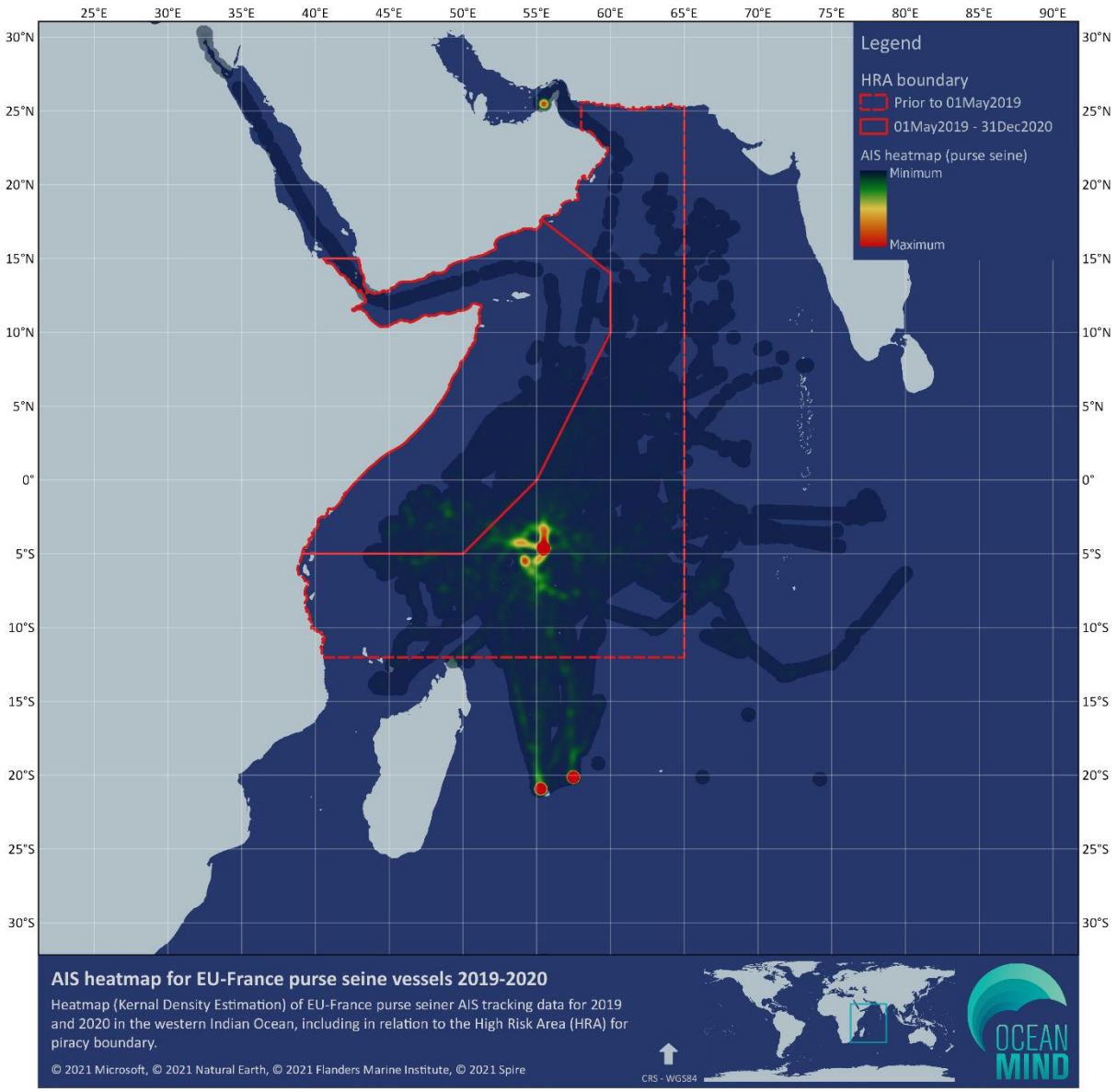


Figure 36: Heatmap of AIS transmissions from the EUFRA purse seine fleet in the AOI, 2019-2020

Various levels and patterns of AIS transmission were present for the 10 EU-France flagged purse seine vessels included in the analysis for 2019 (Table 20). Kernal Density Estimation of AIS transmissions by the EUFRA fleet indicated general use in and around ports (e.g. Port Victoria) and during transits (e.g. the Chagos Archipelago EEZ), and also on the high seas and during likely fishing operations (Figure 36).

EUFRA flagged purse seine vessels transmitted on AIS on an average of 40.9% days of the 731-day analysis period between 01Jan2019 and 31Dec2020. In 2019, there was significant variability in the number of AIS transmission days outside of port between vessels, varying between 110 days (35.1% of transmission days) and 341 days (72.1% of transmission days), though the average was 60.3% across

EUFRA purse seine vessels. The lowest transmission outside of port was observed to be the purse seiner TALENDUIC (35.1% outside of port) although this vessel was the 4th highest-ranked vessel for transmission days as a percentage of total available days (42.8%) during the 2019-2020 analysis period (Table 20). The location of AIS transmissions by the EUFRA fleet suggests that proximity to the HRA for piracy was not a key factor in determining transmission, although within the HRA there is a decrease in the number of transmissions in the HRA closer to the Horn of Africa (Figure 36). However, as shown in Figure 36, this lower density of transmissions may also be related to lower reported catch-effort in this region by EUFRA when compared to the southern extent.

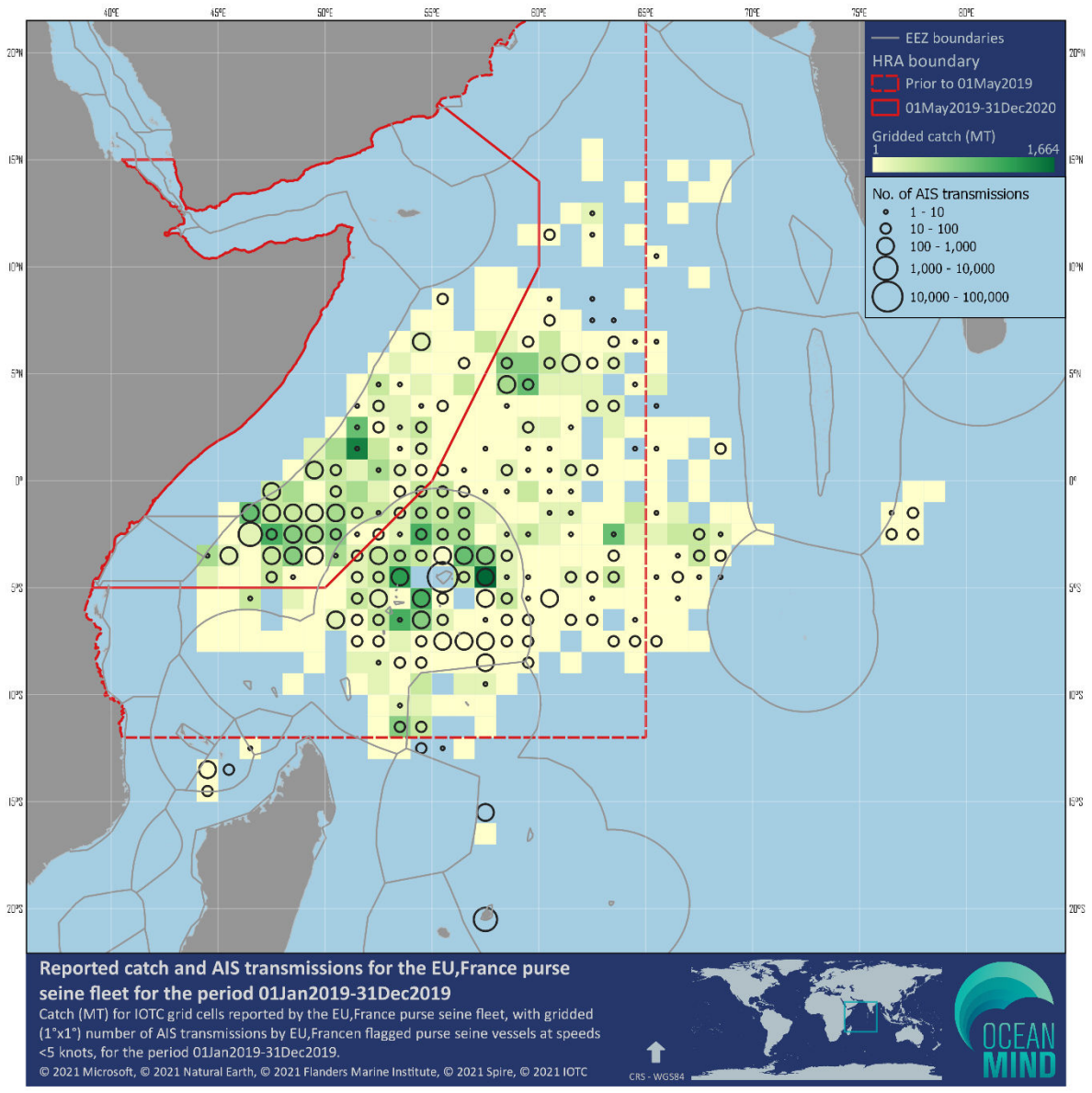


Figure 37: Gridded catch (MT) and AIS transmissions at speed <5 knots for EUFRA purse seiners, 2019

Figure 37 suggests that, in 2019, the EUFRA purse seine fleet continued to transmit on AIS during fishing operations, with most of the grid cells with the highest weight of catch (MT) also having 10-

1,000 AIS transmissions from the EUFRA purse seine fleet. In contrast to the low levels shown by the EUESP fleet, Figure 37 indicates that the EUFRA purse seine fleet transmitted on AIS in 181 of the 362 total grid cells where catch-effort was reported. This may suggest general use of AIS across the fleet during fishing operations, with these 181 grid cells having both reported catch-effort and AIS transmissions at slow-speeds representing 71.2% of overall catch weight in 2019 by EUFRA, although Table 20 indicates variability between vessels of the EUFRA purse seine fleet.

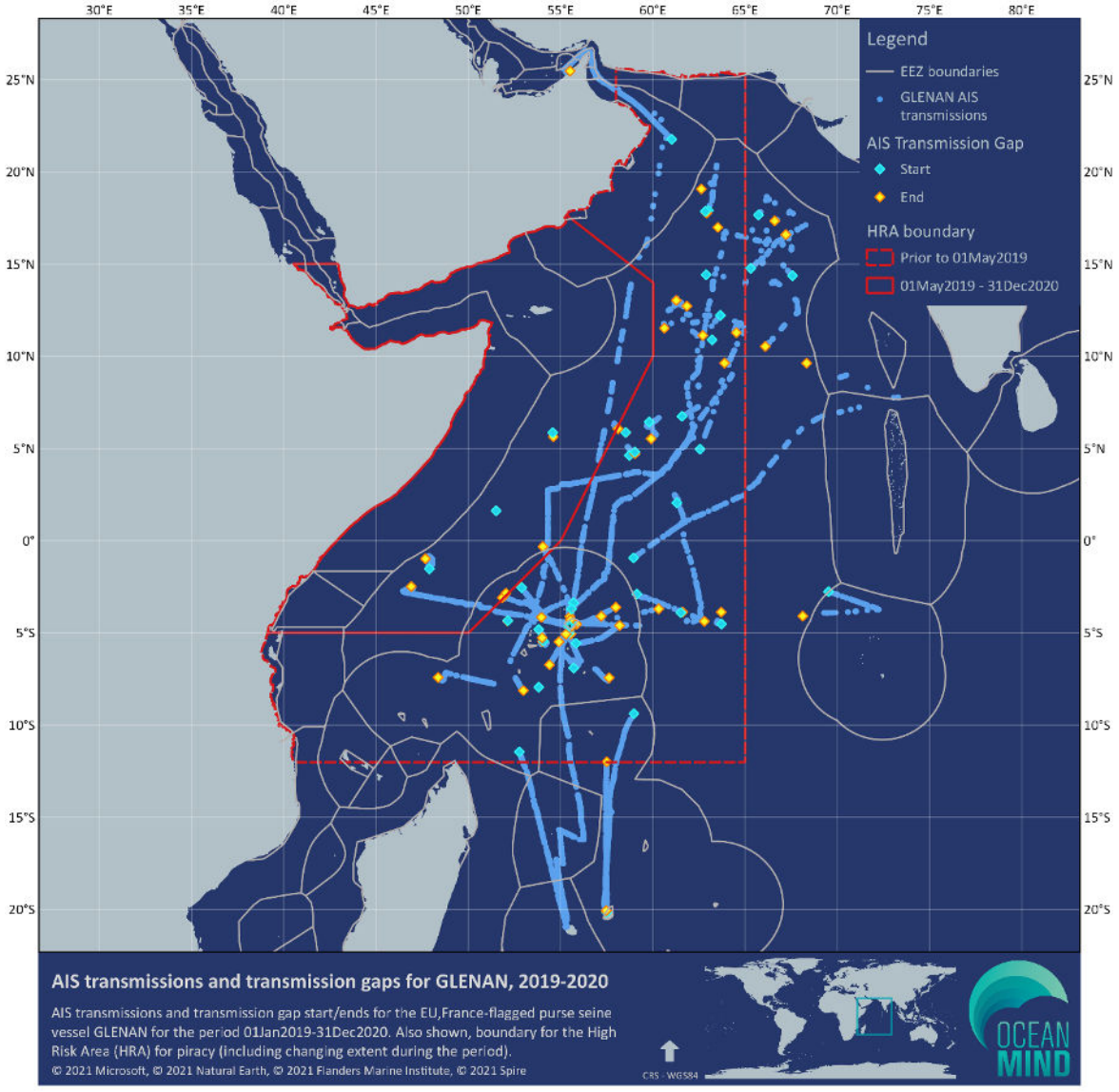


Figure 38: AIS transmissions in 2019 for the EUFRA purse seine vessel GLENAN

As shown in Figure 38 the EUFRA vessel GLENAN exhibited a higher number of AIS transmission ends in the north of the AOI, potentially linking this behaviour to concerns over the HRA for piracy. However, as shown by Figure 38, GLENAN stopped transmitting multiple times during the 2019 analysis period, often within the Seychelles EEZ. Between 28Jul2019 and 30Jul2019, GLENAN exhibited a transmission start close to the Chagos Archipelago EEZ western boundary, partial transit of the EEZ

before changing course and exiting the EEZ again on the western boundary. Shortly upon leaving the Chagos Archipelago EEZ, GLENAN ceased transmitting on AIS (Figure 38).

Table 20: AIS usage by EUFRA-flagged purse seine vessels in the western Indian Ocean AOI 01Jan2019-31Dec2020.

Vessel name	MMSI	IRCS	Longest AIS transmission gap	AIS transmission days	AIS transmission days as percentage of total	AIS transmission days outside of port	Percentage of transmission days outside port	Number of AIS transmissions within HRA*
AVEL VAD	228255000	FNAL	1 mon, 24 days, 19 hrs, 18 min	263	36.0	153	58.2	2,306
BERNICA	660002000	FLTZ	1 mon, 8 days, 8 hrs, 42 min	263	36.0	152	57.8	948
CAP SAINT VINCENT	226169000	FIPP	1 mon, 13 days, 22 hrs, 55 min	473	64.7	341	72.1	7,711
CAP ST MARIE	228875000	FNSM	1 mon, 3 days, 10 hrs, 50 min	322	44.0	234	72.7	1,132
DOLOMIEU	660004900	FIDG	2 mon, 24 days, 3 hrs, 12 min	223	30.5	144	64.6	287
FRANCHE TERRE	660003800	FNSN	1 mon, 3 days, 8 hrs, 10 min	312	42.7	187	59.9	3,051
GLENAN	228231700	FMHD	2 mon, 5 days, 7 hrs, 11 min	295	40.4	173	58.6	1,556
MANAPANY†	660004300	FLSZ	9 mon, 10 days, 2 hrs, 43 min	205	28.0	138	67.3	3,764
TALENDUIC	226240000	FOVN	1 mon, 4 days, 22 hrs, 40 min	313	42.8	110	35.1	401
TREVIGNON	660001900	FMJQ	0 mon, 9 days, 6 hrs, 59 min	322	44.0	182	56.5	2,287

**HRA boundary as of 01May2019*

† MANAPANY reportedly entered dry dock in February 2020, potentially reducing AIS transmission from the vessel after this event

5.3 EU-Italy

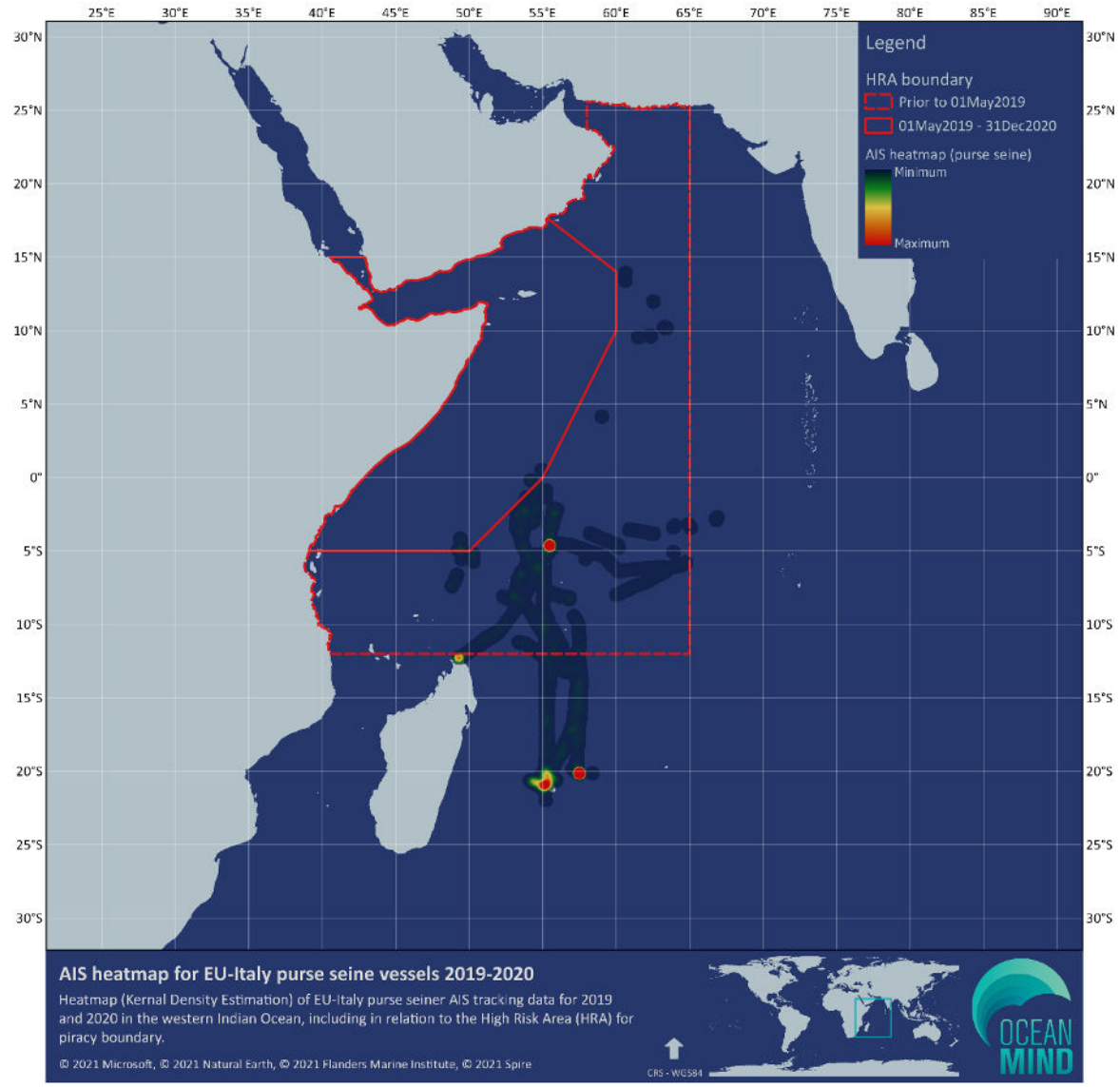


Figure 39: Heatmap of AIS transmissions from the EUITA purse seine fleet in the AOI, 2019-2020

The single EU-Italy flagged purse seine vessel (TORRE ITALIA) included in this analysis showed generally low levels of AIS transmission (Table 21). Kernal Density Estimation of AIS transmissions by the EUITA fleet indicated generally highest use in and around ports and during transits between ports (Figure 39). The vessel TORRE ITALIA transmitted on AIS on 29.0% of days over the 731-day analysis period between 01Jan2019 and 31Dec2020, and transmitted on AIS for 137 days outside of port (88% of transmission days).

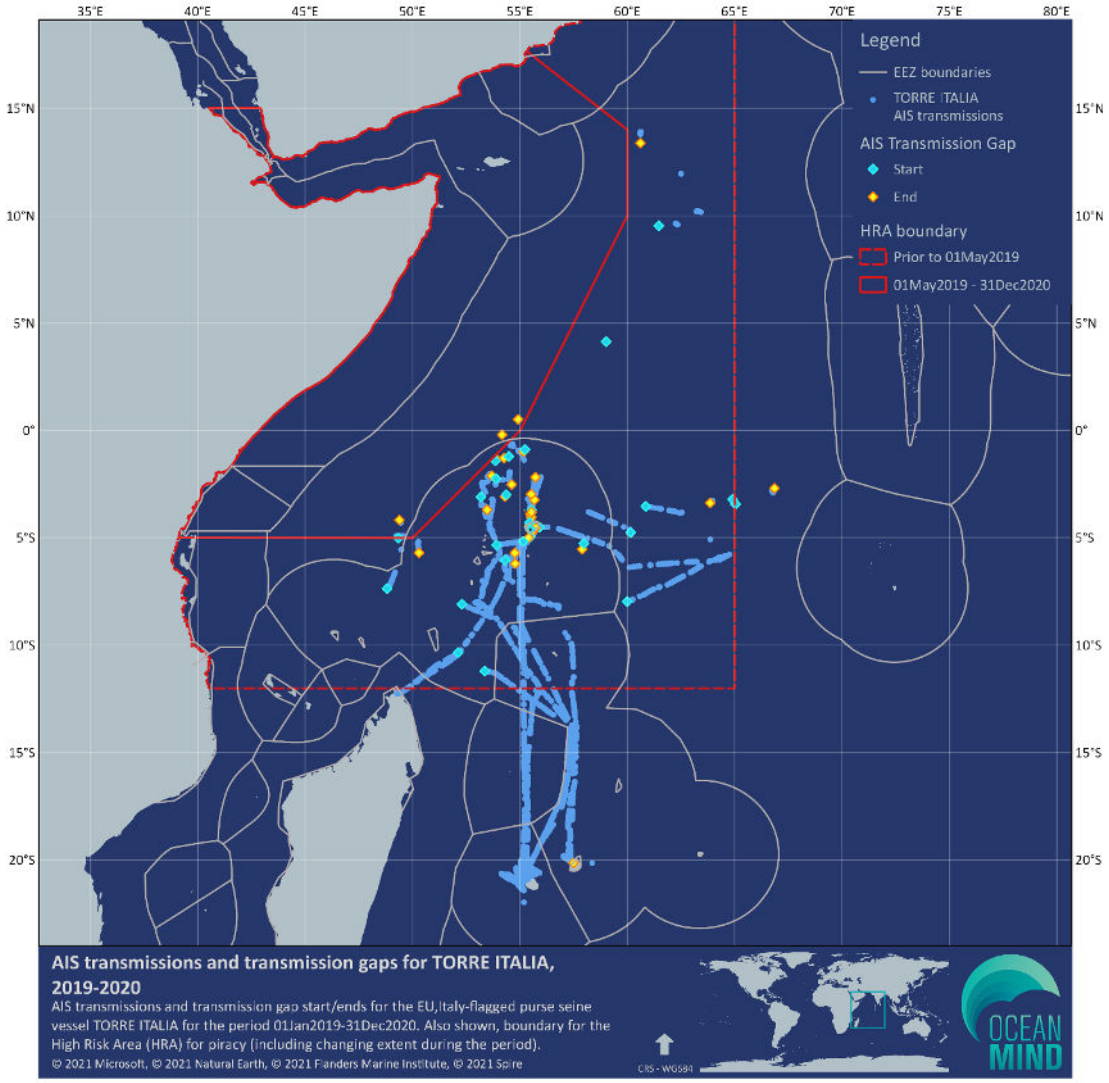


Figure 40: AIS transmissions in 2019 for the EUITA purse seine vessel TORRE ITALIA

As shown in Figure 40, TORRE ITALIA stopped transmitting multiple times during the 2019 analysis period, often within the Seychelles EEZ. However, due to no catch-effort being reported by TORRE ITALIA in 2019 in the AOI, comparison with AIS transmission patterns is not possible for the EUITA fleet.

Despite the lack of catch-effort data for EUITA during the 2019 monitoring period, the TORRE ITALIA transmitted on AIS at least 590 times where the indicative speed was <5 knots. Several of these slower-speeds were transmitted from locations outside of port, including on the high seas, possibly indicating fishing activity and/or vessel meetings at sea. Additionally, this flag-state reports circa 5,000 MT of purse seine catch annually but has not reported any surface gears catch under IOTC since 2015. When considered alongside the possible fishing activity observed during AIS analysis, this may indicate that catch-effort is occurring for EUITA in the IOTC area, but this catch-effort data is not being fully reported or made publicly available.

Table 21: AIS usage by EUITA-flagged purse seine vessels in the western Indian Ocean AOI 01Jan2019-31Dec2020.

Vessel name	MMSI	IRCS	Longest AIS transmission gap	AIS transmission days	AIS transmission days as percentage of total	AIS transmission days outside of port	Percentage of transmission days outside port	Number of AIS transmissions within HRA*
TORRE ITALIA	247354400	IBIO	3 mon, 2 days, 15 hrs, 40 min	212	29.0	137	64.6	388

**HRA boundary as of 01May2019*

5.4 Mauritius

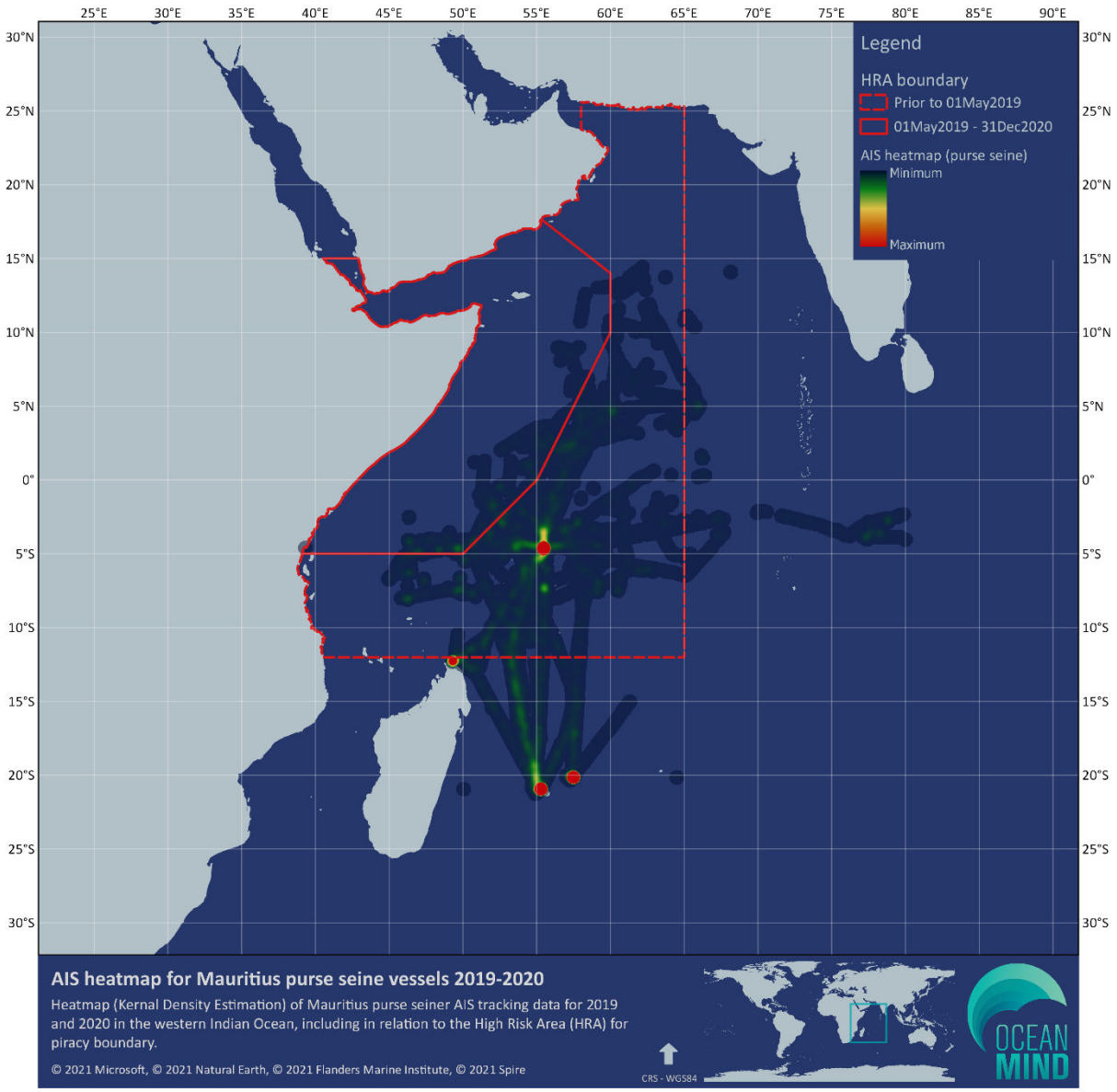


Figure 41: Heatmap of AIS transmissions from the MUS purse seine fleet in the AOI, 2019-2020

The 3 Mauritius flagged purse seine vessels included in this analysis showed different patterns of AIS transmission (Table 22). Kernal Density Estimation of AIS transmissions by the Mauritius fleet indicated generally highest use within and transiting between ports, transit of some EEZs (e.g. the Chagos Archipelago EEZ), and also on the high seas and during possible fishing operations (Figure 41).

As an average, the Mauritius flagged purse seine vessels transmitted on AIS on 42.2% of days over the 731-day analysis period between 01Jan2019 and 31Dec2020. There was variability in the number of AIS transmission days outside of port between the vessels, although BELLE ISLE transmitted notably more days (306) outside of port than the other Mauritius flagged vessels (135 and 179) (Table 22).

BELLE ISLE transmitted both within and outside of port, with transmission days outside of port comprising 76.3% of all transmission days for the period 2019-2020. The purse seiner BELLE ISLE (Figure 42) showed AIS transmission start and end points across the AOI, although there was a notable pattern of AIS transmission behaviour in proximity to the HRA boundary (boundary since 01May2020), suggesting that the HRA might have some influence on AIS usage by MUS purse seiners in the AOI (Figure 42).

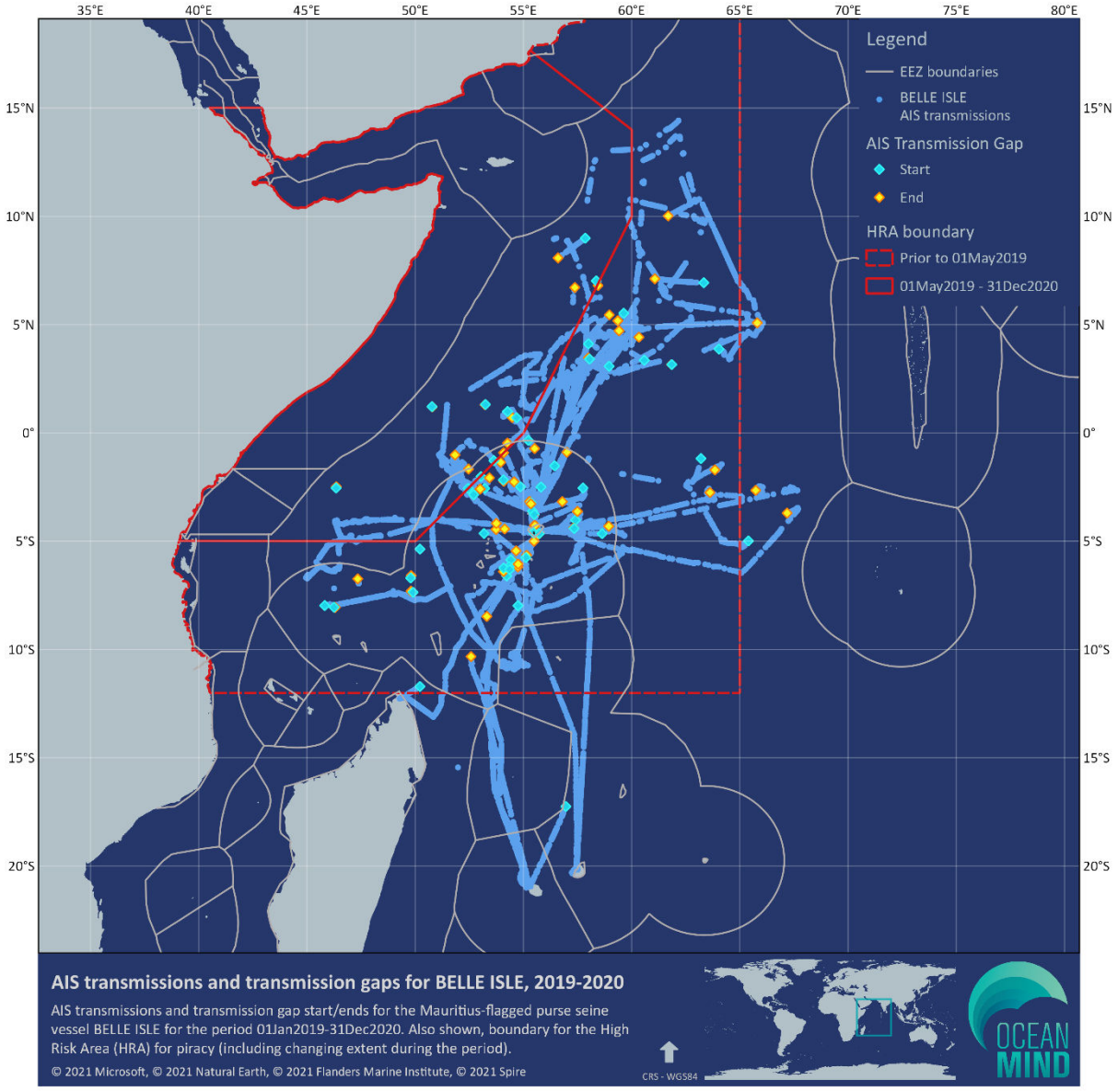


Figure 42: AIS transmissions in 2019 for the MUS purse seine vessel BELLE ISLE

The possible link between MUS purse seine AIS transmissions and the HRA, might provide some context for the trends shown between AIS transmissions and catch-effort illustrated in Figure 43. Many of the grid cells outside of the post 01May2019 HRA boundary with higher catch-weight have associated AIS transmissions with MUS purse seiners, while a higher proportion of such cells within

the HRA do not. However, Figure 43 also shows that there are many grid cells with reported catch effort away from the HRA which do not have associated AIS transmissions, indicating that reported MUS purse seine activity was not conducted while visible on AIS. A total of 195 grid cells were reported with catch-effort from the MUS fleet in 2019, 83 of which had AIS transmissions from the fleet in the same year, these 83 grid cells representing 54.4% of total reported catch weight (MT).

Of additional note in Figure 43 are the grid cells with AIS transmissions at slow speed, without reporting of catch in the same grid cell. Although this may be a product of slow speed for other vessel activity, such as transhipment or bunkering, there is the potential for these to be indicative of misreporting or errors in the reporting of catch areas.

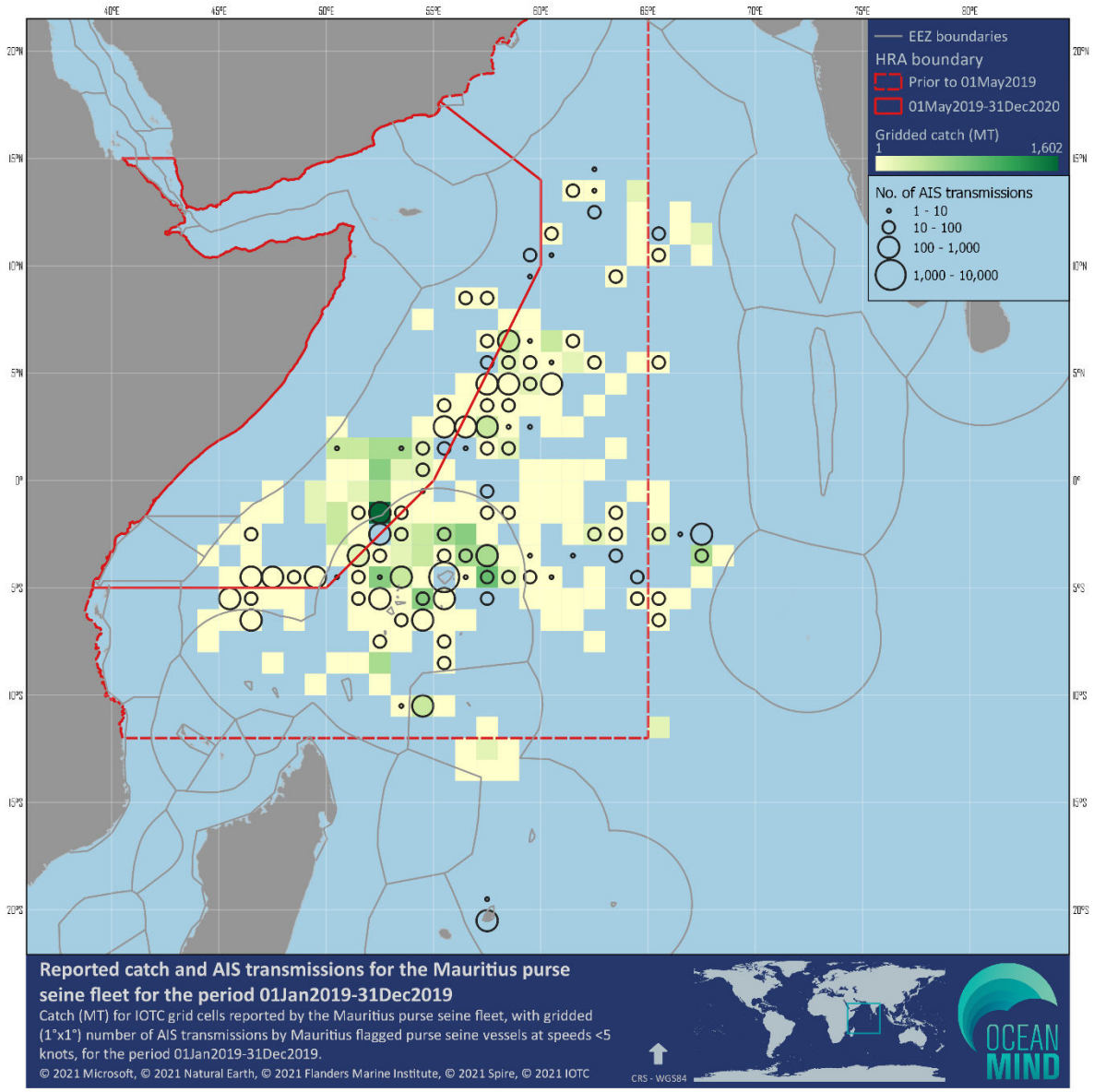


Figure 43: Gridded catch (MT) and AIS transmissions at speeds <5 knots for MUS purse seiners, 2019

Table 22: AIS usage by MUS-flagged purse seine vessels in the western Indian Ocean AOI 01Jan2019-31Dec2020.

Vessel name	MMSI	IRCS	Longest AIS transmission gap	AIS transmission days	AIS transmission days as percentage of total	AIS transmission days outside of port	Percentage of transmission days outside port	Number of AIS transmissions within HRA*
FV BELLE ISLE	645374000	3BRZ	1 mon, 7 days, 17 hrs, 51 min	401	54.9	306	76.3	7,917
FV BELLE RIVE	645373000	3BRY	1 mon, 6 days, 2 hrs, 13 min	241	33.0	135	56.0	879
FV BELOUVE†	645524000	3BTL	1 mon, 1 days, 14 hrs, 15 min	277	38.8	179	64.6	1,163

**HRA boundary as of 01May2019*

†Prior to 19Jan2019, the vessel BELOUVE was flagged to EUFRA (MMSI 660005100). Consequently, the number of potential AIS transmission days was reduced to 713 days (19Jan2019-31Dec2020).

5.5 Seychelles

Kernal Density Estimation of AIS transmissions by the 13 purse seine vessels of the SYC fleet included in this analysis indicated generally highest around ports (e.g. Port Victoria) and also on the high seas and during possible fishing operations (Figure 44)

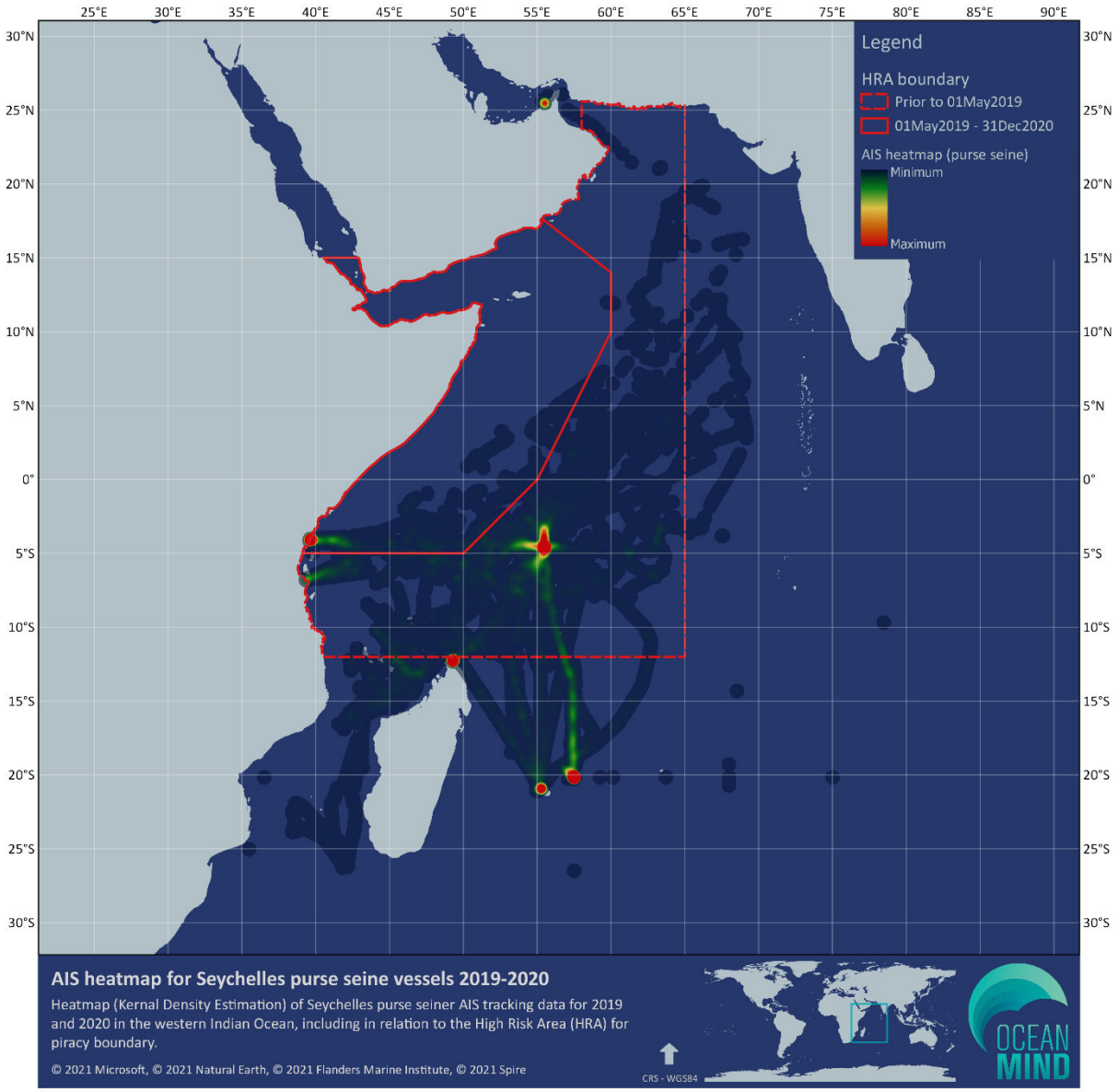


Figure 44: Heatmap of AIS transmissions from the SYC purse seine fleet in the AOI, 2019-2020

SYC flagged purse seine vessels only transmitted on AIS on an average of 37.2% of days over the 731-day analysis period between 01Jan2019 and 31Dec2020. There was significant variability in the number of AIS transmission days outside of port between vessels, varying between 42 days (30% of transmission days) and 374 days (71.2% of transmission days). The lowest transmission outside of port was observed to be the purse seiner IZARO (30% outside of port) and only transmitting 19.2% of

possible days during the 2019-2020 analysis period (Table 23). The overall low levels of AIS transmission by the SYC purse seine fleet in the AOI in 2019-2020, together with the location of transmissions, suggests that transmission behaviour and AIS use by these vessels cannot be wholly explained by the HRA for piracy.

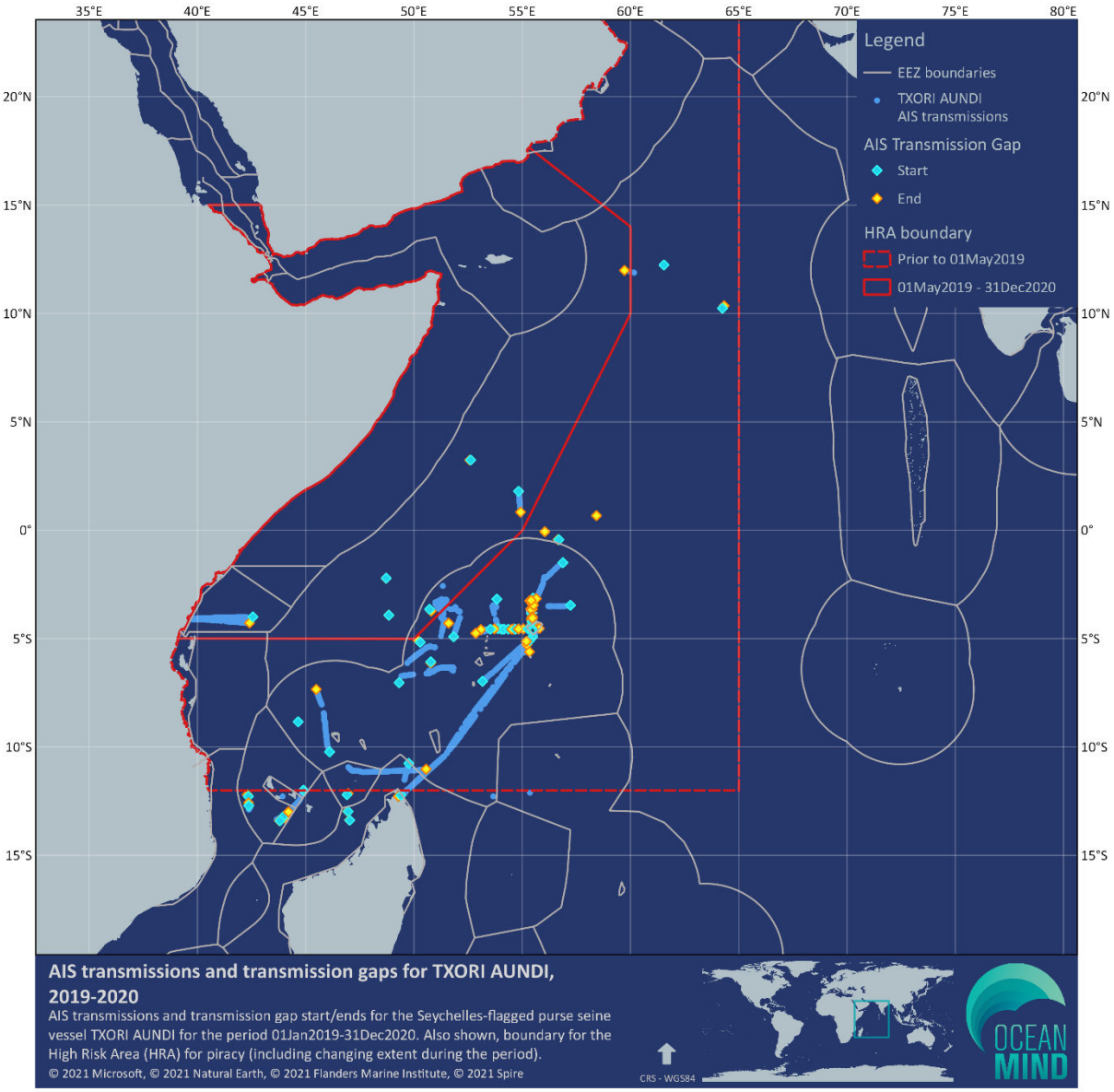


Figure 45: AIS transmissions in 2019 for the SYC purse seine vessel TXORI AUNDI

As shown in Figure 45 and Table 23, the vessel TXORI AUNDI exhibited a lower number of AIS transmission days (29.4%) than average for the SYC purse seine fleet, although 68.8% of these transmission days were outside of port. However, as shown by Figure 45, TXORI AUNDI frequently stopped and started transmitting in 2019 within the Seychelles EEZ, with very few transmissions on the high seas, inside or outside the HRA. This may suggest that although TXORI AUNDI did transmit

outside of port, transmissions ceased at some point during transit from port to fishing area as the vessel shows few transmission tracks that indicate behaviour linked to fishing operations.

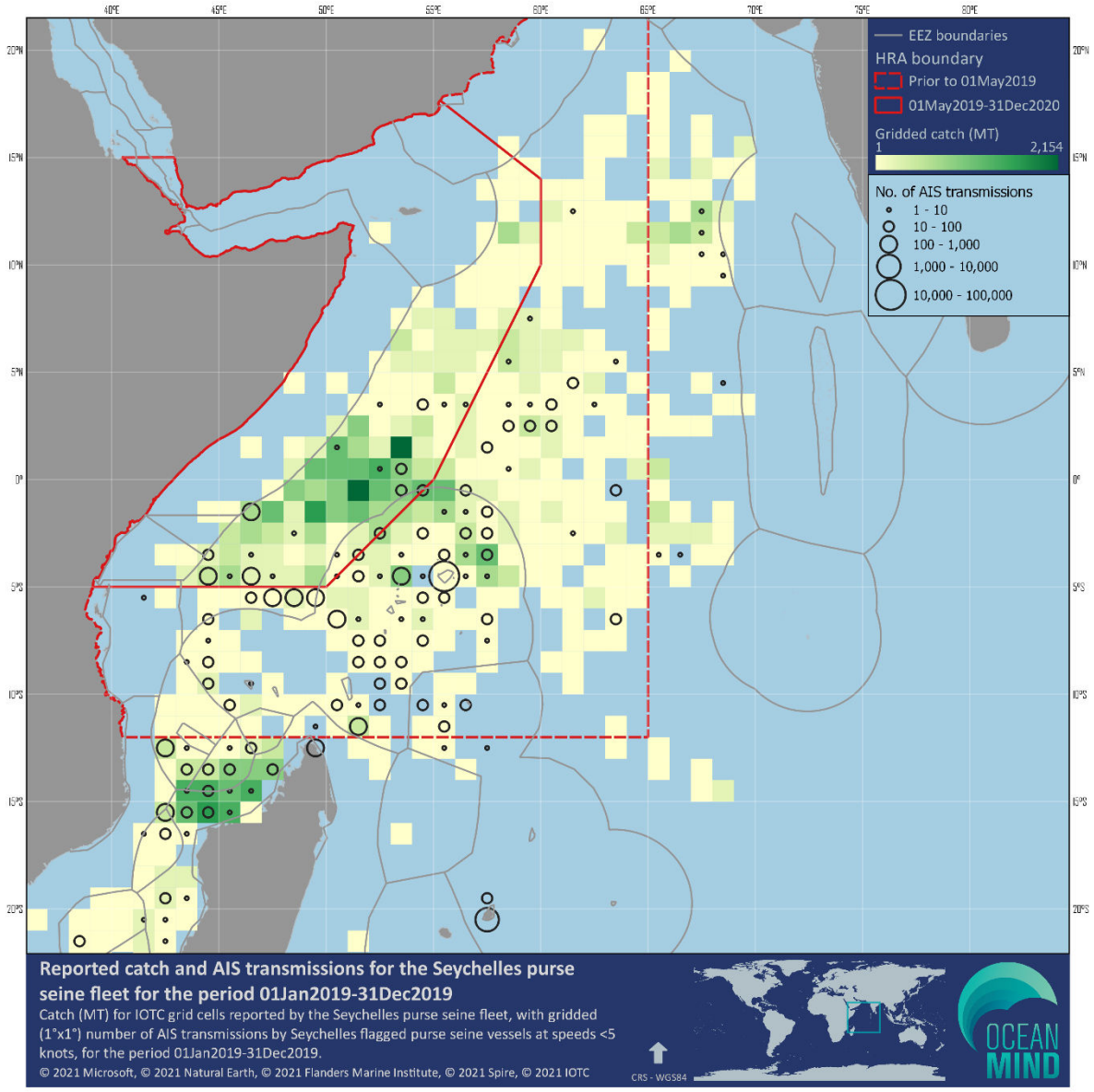


Figure 46: Gridded catch (MT) and AIS transmissions at speeds <5 knots for SYC purse seiners, 2019

Figure 46 illustrates that many of the grid cells with highest catch weights (MT) in 2019, as reported by the SYC purse seine fleet, do not contain any AIS transmissions from the same fleet. As shown in Figure 46, only 120 of the 467 total grid cells where catch-effort was reported by the SYC purse seine fleet in 2019 contained any AIS transmissions. These 120 grid cells with both catch-effort and slow-speed AIS transmissions represented 36.3% of total reported catch weight for 2019 for the SYC fleet, suggesting very low use of AIS during fishing operations. However, many of these high catch-weight grid cells lay within the HRA for piracy and thus the risk of piracy may have had some influence on AIS

use. Conversely, Figure 46 also shows many grid cells outside of the HRA, both on the high seas and inside of coastal state EEZs, without any corresponding AIS transmissions.

Table 23: AIS usage by SYC-flagged purse seine vessels in the western Indian Ocean AOI 01Jan2019-31Dec2020.

Vessel name	MMSI	IRCS	Longest AIS transmission gap	AIS transmission days	AIS transmission days as percentage of total	AIS transmission days outside of port	Percentage of transmission days outside port	Number of AIS transmissions within HRA*
ARTZA	664271000	S7JT	1 mon, 4 days, 1 hr, 26 min	257	35.2	105	40.8	255
DRACO	664348000	S7TW	1 mon, 9 days, 5 hrs, 14 min	324	44.3	165	50.9	5,472
EUSKADI ALAI	664578000	S7UO	2 mon, 6 days, 10 hrs, 4 min	243	33.2	55	22.6	2,342
GALERNA II	664576000	S7VH	4 mon, 0 days, 0 hrs, 23 min	260	35.6	119	45.8	0
GALERNA III	664584000	S7UG	2 mon, 25 days, 3 hrs, 50 min	224	30.6	90	40.2	23,054
INTERTUNA TRES	664223000	S7SA	2 mon, 21 days, 10 hrs, 34 min	223	30.5	57	25.6	1
IZARO	664563000	S7OK	8 mon, 28 days, 18 hrs, 56 min	140	19.2	42	30.0	934
JAI ALAI	664579000	S7UK	1 mon, 1 day, 23 hrs, 32 min	307	42.0	104	33.9	2,726
MORN SESELWA	664545000	S7JA	1 mon, 16 days, 1 hr, 31 min	525	71.8	374	71.2	4,744
MORNE BLANC	664097000	S7TO	1 mon, 4 days, 22 hrs, 49 min	295	40.4	160	54.2	633
PLAYA DE ANZORAS	664572000	S7IJ	1 mon, 4 days, 13 hrs, 40 min	264	36.1	69	26.1	314
TXORI AUNDI	664268000	S7SZ	1 mons, 20 days, 2 hrs, 15 min	215	29.4	148	68.8	6,737
TXORI TOKI	664326000	S7LN	1 mon, 6 days, 22 hrs, 23 min	262	35.8	76	29.0	676

**HRA boundary as of 01May2019*

5.6 Purse seine supply vessels

Fourteen (14) purse seine supply vessels authorised under IOTC, transmitted in the AOI during the 2019-2020 analysis period (Table 24).

Table 24: IOTC authorised purse seine supply vessels included in AIS transmission analysis for the period 2019-2020 in the western Indian Ocean AOI.

Vessel name	MMSI	IRCS	Flag-state
ALAKRANTXU	224054360	EAON	Spain (EU)
ARCHANDA	224883000	EAXT	Spain (EU)
BALBAYA	645474000	3BSY	Mauritius
CHRISDERIC II	228232000	FQAT	France (EU)
HAIZEA BOST	224428000	EATY	Spain (EU)
HAIZEA LAU	664078000	S7SY	Seychelles
HAIZEA SEI	664066000	S7WD	Seychelles
JANVIER LOUIS RAPHAEL	226254000	FSXU	France (EU)
JEAN LOUIS RAPHAEL 2	227370000	FGTX	France (EU)
KERSAINT	635019200	FLVK	France (EU)
MALOYA	664093000	S7IU	Seychelles
TXORI BAT	664325000	S7TV	Seychelles
TXORI BI	224218000	ECEE	Spain (EU)
TXORI HIRU	224594000	EBWI	Spain (EU)

As shown in Figure 47, the highest densities for AIS transmissions from purse seine supply vessels was in proximity to ports, although lower densities are also present in high seas areas and during transit of several EEZs, such as the Chagos Archipelago. However, there is some indication of AIS transmission gaps by at least one purse seine supply vessel. As several of these transmission gaps are situated a considerable distance from the HRA for pricey, it is unlikely that the risk of piracy was a sole factor in determining where a purse seine supply vessel transmitted on AIS.

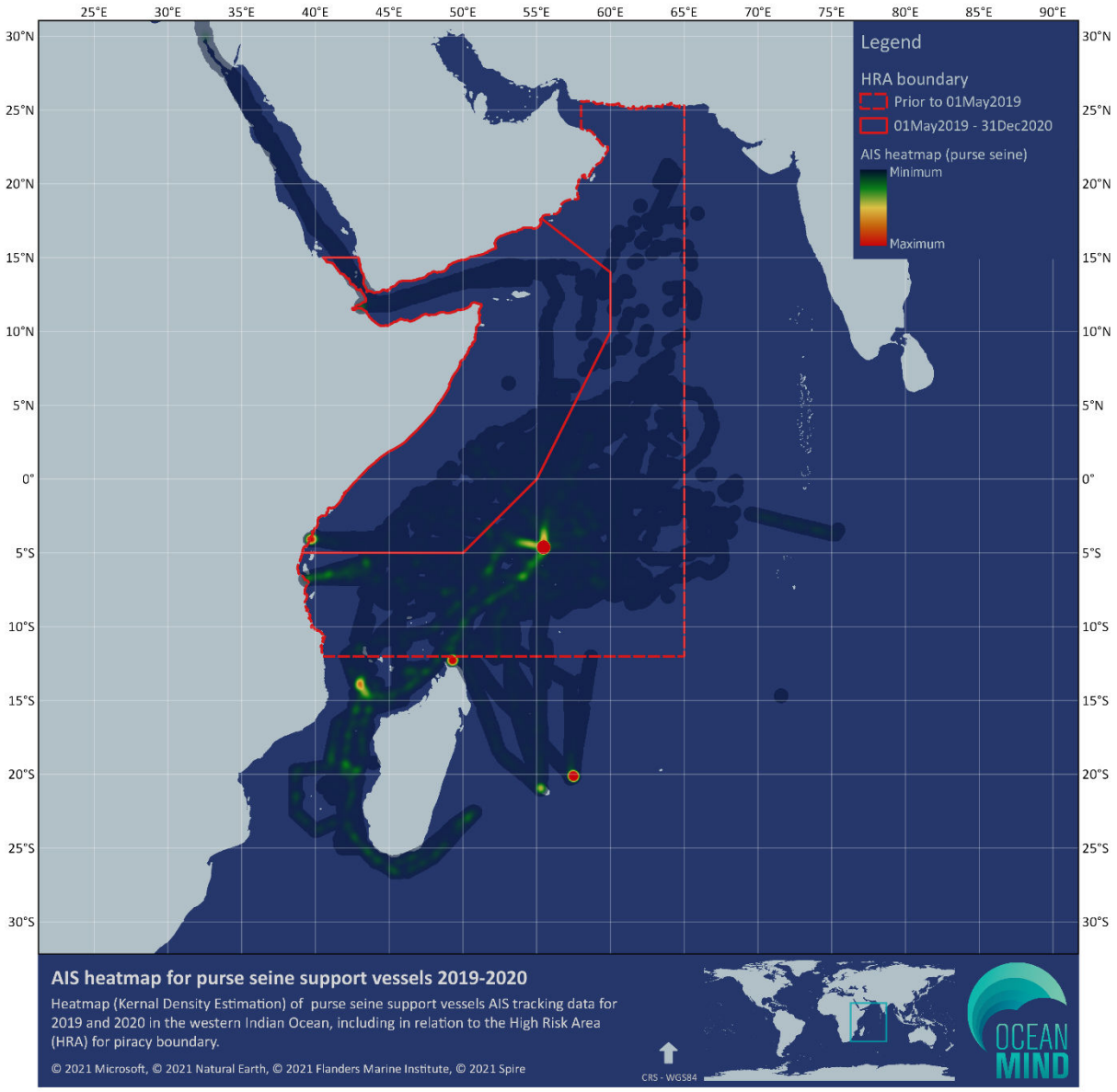


Figure 47: Heatmap of AIS transmissions from purse seine supply vessels in the AOI, 2019-2020

6 Chagos Archipelago

Catch-effort for multiple gears as reported to IOTC by flag-states in grid cells were spatially and temporally analysed, the results being presented here. Catch-effort is subdivided into Purse seine, Longline, and other gears (handline and gillnet) for the purpose of reporting for the Chagos Archipelago EEZ and adjoining grid cells.

There currently exists a well-publicised dispute over the sovereignty of the Chagos Archipelago between the United Kingdom and the Republic of Mauritius. Additionally, objections have been raised by the Republic of Maldives regarding the delimitation of the maritime boundary to the north of the Chagos Archipelago EEZ.

6.1 Purse seine

Catch-effort was reported by purse seiners of 6 flag-states in grid cells within, or along the boundary of, the Chagos Archipelago EEZ for the period 2016-2020 (Figures 48-49). Catch-effort was reported by the fleets EUESP (2016-2020), EUFRA (2016-2020), JPN (2018, 2020), KOR (2016-2018), MUS (2016-2020) and SYC (2016-2020). Although catch-effort was reported predominantly from boundary cells, reports from 2017 and 2018 indicated effort may have been present inside the Chagos Archipelago EEZ by the flag states EUESP (2017), EUFRA (2017-2018) and SYC (2017- 2018) (Table 24).

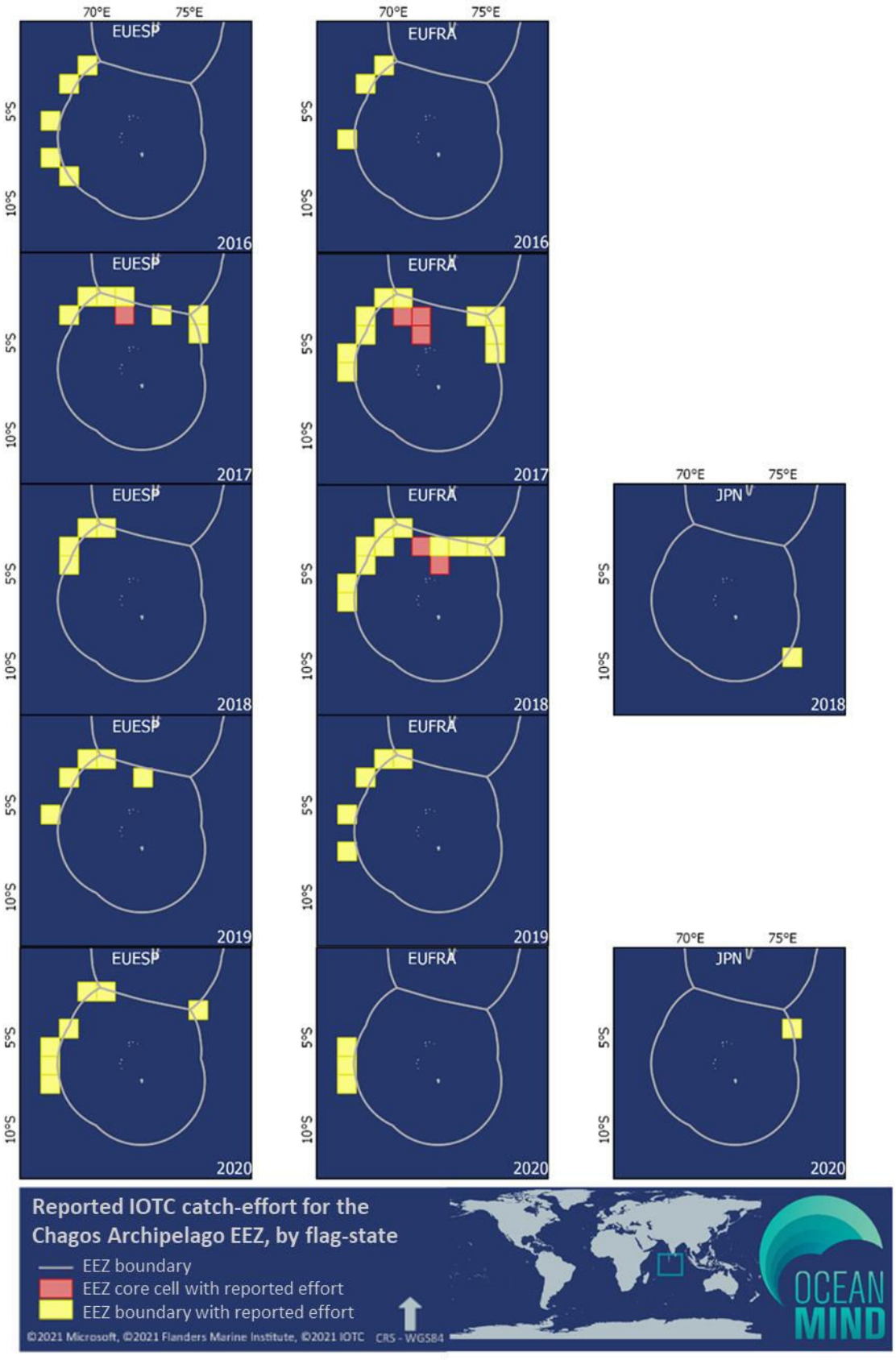


Figure 48: Location of EUESP, EUFRA and JPN purse seine fishing effort associated with the Chagos Archipelago EEZ in 2016-2020

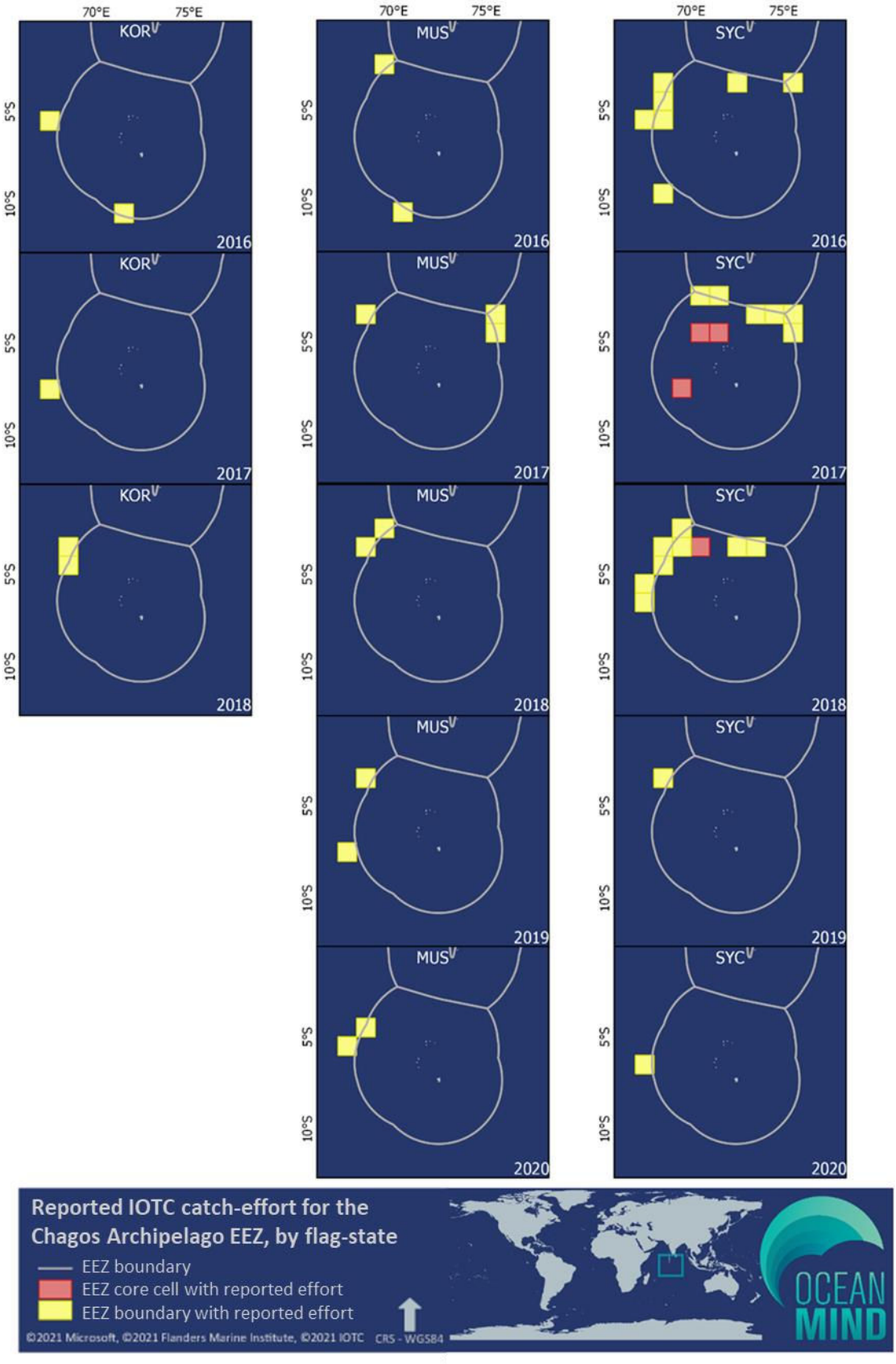


Figure 49: Location of KOR, MUS and SYC purse seine fishing effort associated with the Chagos Archipelago EEZ in 2016-2020

Table 24: Annual total effort (effort unit) and catch (metric tonnes) reported by purse seiners within and along the boundary of the Chagos Archipelago EEZ for the period 2016-2020

Year	2016						2017						2018						2019						2020					
Location	EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary		
Effort months	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M
	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J
	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S
	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D
Flag State *Reported effort* Total catch (metric tonnes)				**EU-Spain** *89.6 FHOURS* 455.69 MT **EU-France** *36.7 FHOURS* 77.99 MT **South Korea** *4 SETS* 90 MT **Mauritius** *2 SETS* 11.24 MT **Seychelles** *160.16 FHOURS* 314.47 MT			**EU-Spain** *12.2 FHOURS* *9 HOURS* 0 MT **EU-France** *61.2 FHOURS* *192 HOURS* 0 MT **Seychelles** *53.17 FHOURS* 0 MT			**EU-Spain** *224.5 FHOURS* 243.81 MT **EU-France** *479.4 FHOURS* *192 HOURS* 1,148.35 MT **South Korea** *1 SETS* 15 MT **Mauritius** *7 SETS* 322.07 MT **Seychelles** *111.41 FHOURS* 236.99 MT			**EU-France** *24.44 FHOURS* 0 MT **Seychelles** *13.26 FHOURS* 0 MT			**EU-Spain** *88.98 FHOURS* 450.52 MT **EU-France** *1,050.1 FHOURS* 4,790.24 MT **Japan** *2 SETS* 15 MT **South Korea** *3 SETS* 75 MT **Mauritius** *10 SETS* 141.63 MT **Seychelles** *504.79 FHOURS* 1,916.21 MT				**EU-Spain** *45.93 FHOURS* 22.13 MT **EU-France** *10 SETS* 129.56 MT **Mauritius** *2 SETS* 3.15 MT **Seychelles** *10.53 FHOURS* 63.21 MT				**EU-Spain** *104.16 FHOURS* 349.01 MT **EU-France** *6 SETS* 212.03 MT **Japan** *2 SETS* 65 MT **Mauritius** *6 SETS* 75.89 MT **Seychelles** *13.52 FHOURS* 88.47 MT

6.2 Longline

Longline catch-effort data was generally only available at 5°x5° resolution in the vicinity of the Chagos Archipelago EEZ. However, MDV reported longline catch-effort at 1°x1° resolution in the years 2016-2018, the resolution being reduced for illustration in Figures 50-52. Catch-effort was reported by flag-states using longline gear in grid cells around the Chagos Archipelago EEZ boundary in all years of the analysis period 2016-2020 (Figures 50-54).

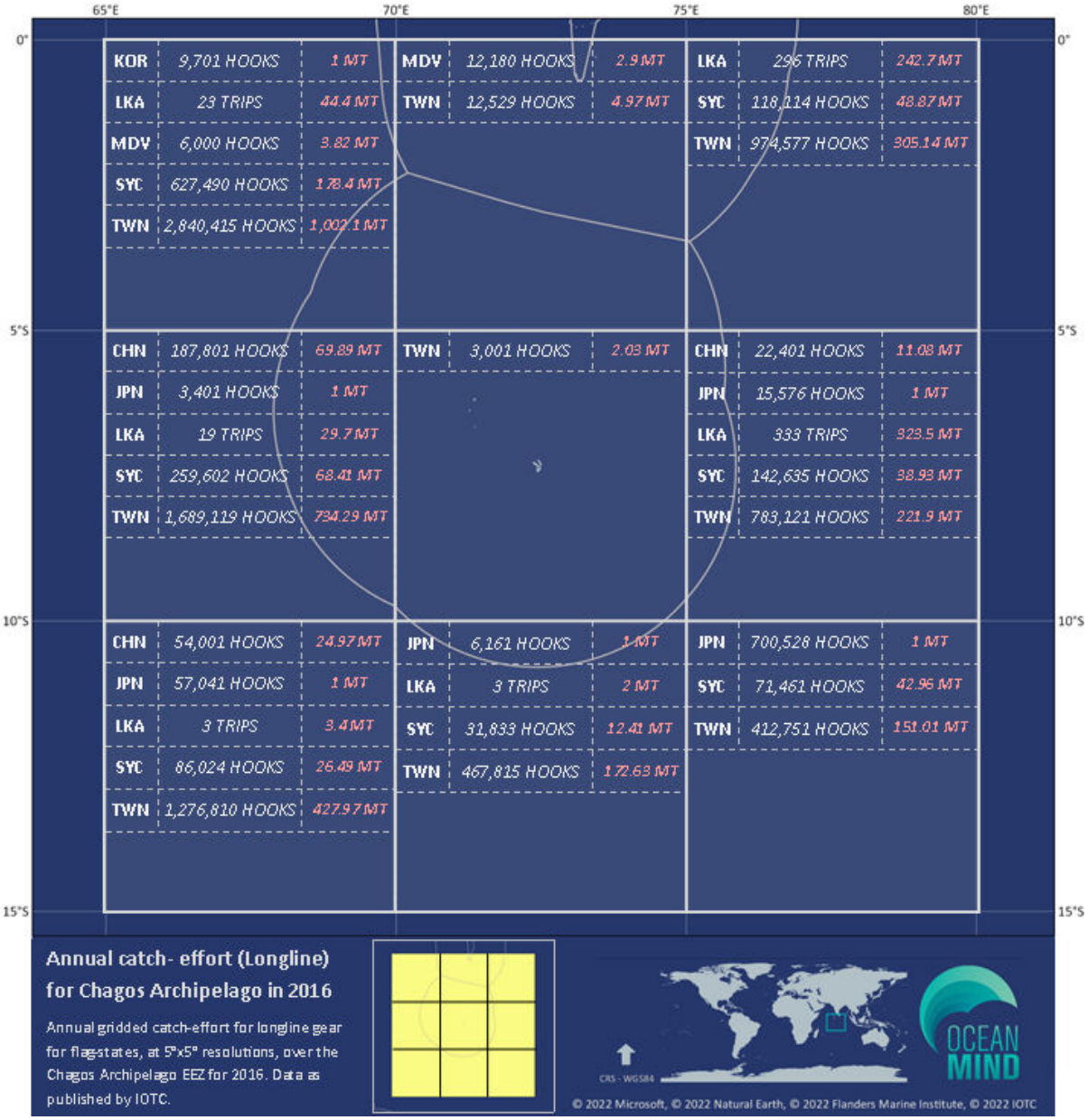


Figure 50: Location of reported annual longline catch-effort by fleets in grid cells (5°x5°) associated with the Chagos Archipelago EEZ in 2016

Longline catch-effort was reported from grid cells around the Chagos Archipelago EEZ in all months of 2016. As illustrated and reported in Figure 50, 7 flag-states reported longline catch effort around the Chagos Archipelago EEZ in 2016 (CHN, JPN, KOR, LKA, MDV, SYC, TWN) in 2016. Catch-effort was only reported by the flag-states, MDV and TWN, in 2016 in grid cells where the majority of the grid cell area was within the Chagos Archipelago EEZ. Although it is possible that some catch-effort was located within the Chagos Archipelago EEZ, the annual effort in 2016 reported by TWN was <3.1% of that in neighboring grid cells for the same period. This suggests that this considerably lower effort was in the cell area outside of the Chagos Archipelago EEZ, although there remains the risk of potential incursion by longline vessels across the Chagos Archipelago EEZ boundary.

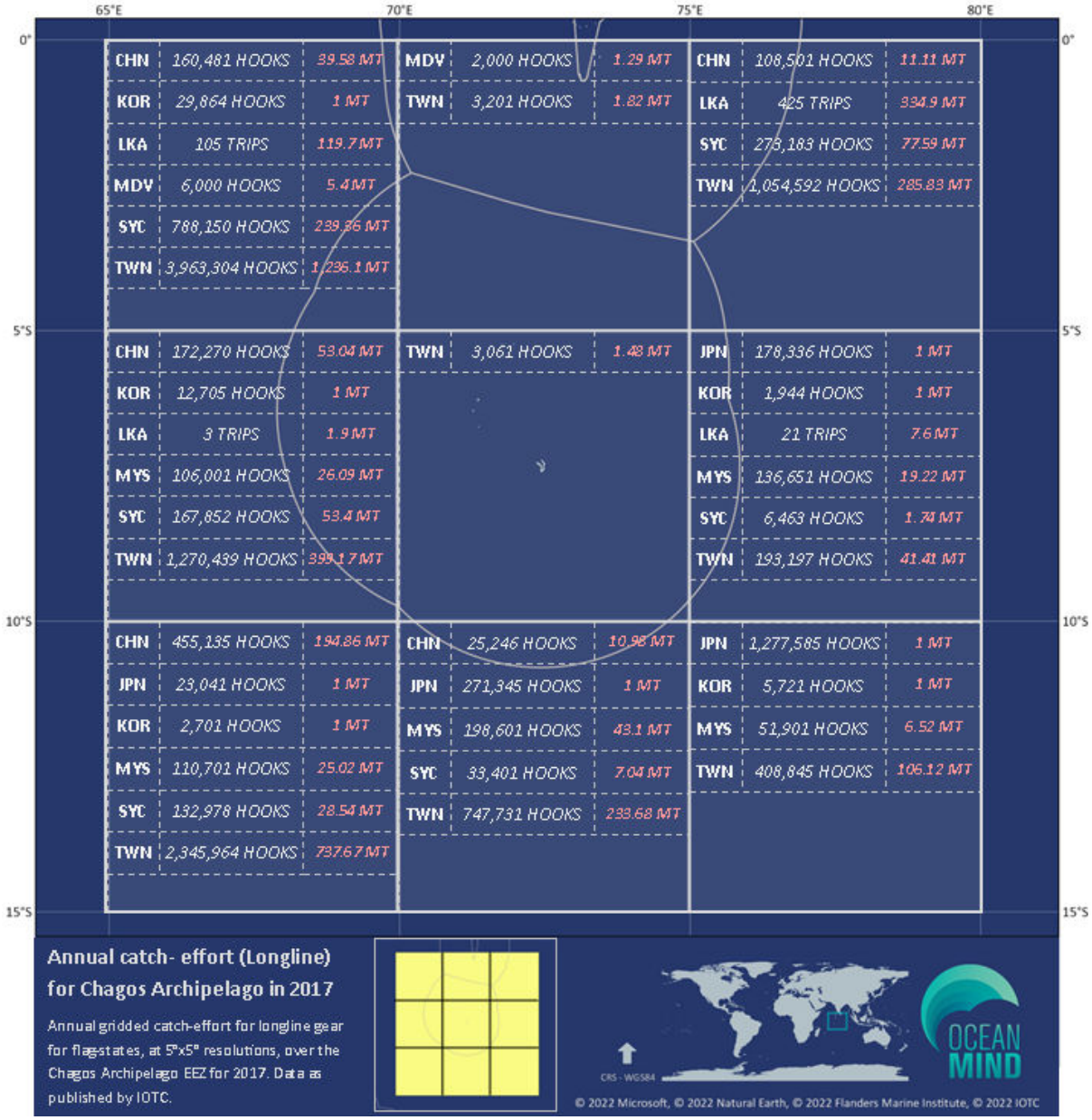


Figure 51: Location of reported annual longline catch-effort by fleets in grid cells (5°x5°) associated with the Chagos Archipelago EEZ in 2017

Eight (8) flag-states reported longline catch-effort in grid cells associated with the Chagos Archipelago EEZ in 2017, these being CHN, JPN, KOR, LKA, MDV, MYS, SYC and TWN (Figure 51). As reported for 2016, catch-effort was present in all months of 2017, in grid cells associated with the Chagos Archipelago EEZ. Similarly, as in 2016, only TWN reported catch-effort within the grid cell centered over the Chagos Archipelago EEZ. However, this reported effort by TWN was <1.7% of that reported by the same flag-state in cells outside of the Chagos Archipelago EEZ, and may indicate that this catch-effort was located in the limited grid cell area outside of the EEZ. In the grid cell covering the boundary of the Chagos Archipelago and Maldives boundary, longline effort reported by TWN was similarly low, relative to neighboring cells, suggesting that catch-effort was in high seas areas. MDV catch-effort reported in this northern cell is likely to be from MDV flagged vessels operating longlines within the Maldives EEZ.

Seven (7) flag-states (CHN, JPN, LKA, MDV, MYS, SYC, TWN) reported longline catch-effort in grid cells in and around the Chagos Archipelago EEZ in 2018 (Figure 52). No catch-effort was reported in the central grid cell, although MYS reported catch-effort in the grid cell covering much of the boundary between the Chagos Archipelago and Maldives EEZ, although a limited amount of this grid cell was situated on the High Seas. MDV catch-effort from longline gear reported in the northern central cell was likely located along the boundary of, or within the Maldives EEZ. MYS longline catch-effort reported in the northern central cell, covering the Chagos Archipelago and Maldives EEZ boundary was considerably lower than that in adjacent cells (<4.2%), but considering the very small area of the grid cell located on the high seas it is possible that some MYS longline catch-effort was present in either the Chagos Archipelago or Maldives EEZ in 2018.

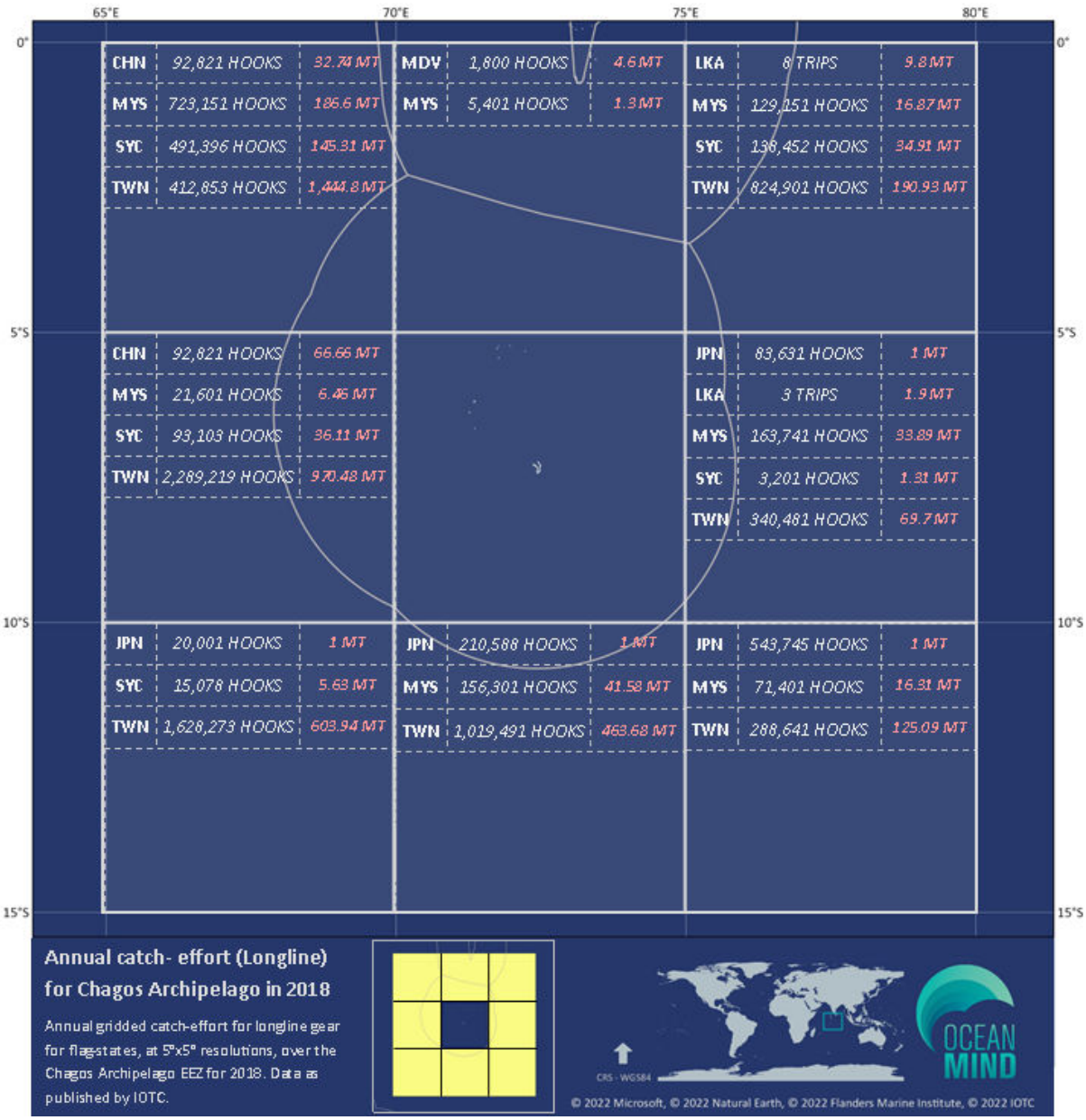


Figure 52: Location of reported annual longline catch-effort by fleets in grid cells (5°x5°) associated with the Chagos Archipelago EEZ in 2018

Six (6) flag-states (CHN, JPN, LKA, MYS, SYC, TWN) reported longline catch-effort in grid cells surrounding the Chagos Archipelago EEZ in 2019 (Figure 53). For the first time since 2017, longline catch-effort was reported in the grid cell that mainly falls within the Chagos Archipelago EEZ, in 2019 by TWN. However, as in 2016 and 2017, this reported effort was very low when compared to adjacent grid cells (<1.2%) and so may indicate that this longline effort was in the small area of the cell outside of the Chagos Archipelago EEZ. LKA reported longline catch-effort in the grid cell covering the Chagos

Archipelago-Maldives EEZ boundary (Figure 53), being very low (<0.7%) of that reported in adjacent cells.

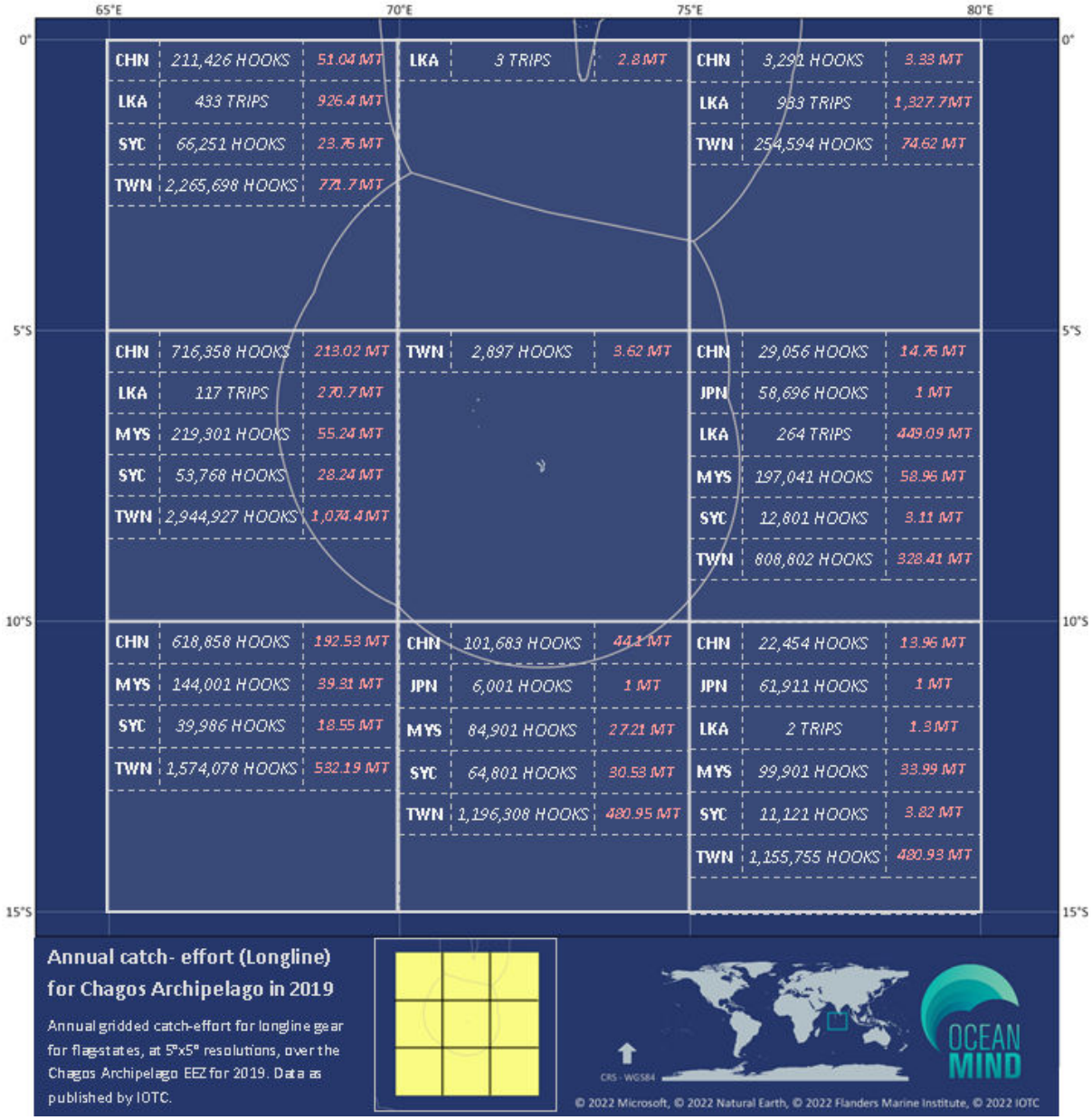


Figure 53: Location of reported annual longline catch-effort by fleets in grid cells (5°x5°) associated with the Chagos Archipelago EEZ in 2019

Six (6) flag states (CHN, JPN, KOR, LKA, MYS and TWN) reported catch-effort from longline gears around the Chagos Archipelago EEZ in 2020 (Figure 54). No catch-effort from longline gear was reported in the grid cell almost entirely within the Chagos Archipelago EEZ in 2020. However, LKA did report 3 TRIPS of longline effort in the northern central grid cell, over the Chagos Archipelago and Maldives EEZ boundary. This catch-effort reported by LKA was, as in previous years, very low when compared to adjacent cells and so may have been in the small high seas area of this grid cell.

Figure 54: Location of reported annual longline catch-effort by fleets in grid cells (5°x5°) associated with the Chagos Archipelago EEZ in 2020

6.3 Other gears

Only 3 flag-states reported effort from gear other than purse seine and longline in grid cells associated with Chagos Archipelago during the analysis period 2016-2020. As shown in Table 25, UKOT reported catch-effort using handlines in all months over the period 2017-2020, while LKA only reported catch-effort in 10 months of the year 2020. MDV reported catch-effort along the Chagos Archipelago EEZ boundary in all months of 2016-2019, but only 4 months of 2020, likely due to the withdrawal of coastal longline gears. MDV reported catch-effort using handline and coastal longline (Coastal LL), both in grid cells within the Chagos Archipelago EEZ (2016 only), and along the Chagos Archipelago EEZ boundary (2016-2020). The within Chagos Archipelago EEZ effort in 2016 was coastal longline effort of 800 HOOKS. Whether this activity reported within the Chagos Archipelago EEZ was associated with the northern boundary dispute is unclear.

Catch effort was reported by UKOT (Handline) in the years 2017-2020, and LKA (Gillnet) in 2020, as shown in Table 25. UKOT reported catch-effort in grid cells entirely inside the Chagos Archipelago EEZ, in 2020 (Figure 55). However, due to the low resolution of UKOT catch-effort data from 2017-2019, it is likely that some catch effort was located within the Chagos Archipelago EEZ during this period. Of additional note is the very high effort reported by UKOT in all years of the analysis period, reporting >6300 days of annual handline effort in a single grid cell in every year of 2017-2020. Given this very high recorded effort, and only a very limited area around Diego Garcia open to fishing, this handline effort appears to be abnormally high, particularly when considering the comparatively low catch recorded.

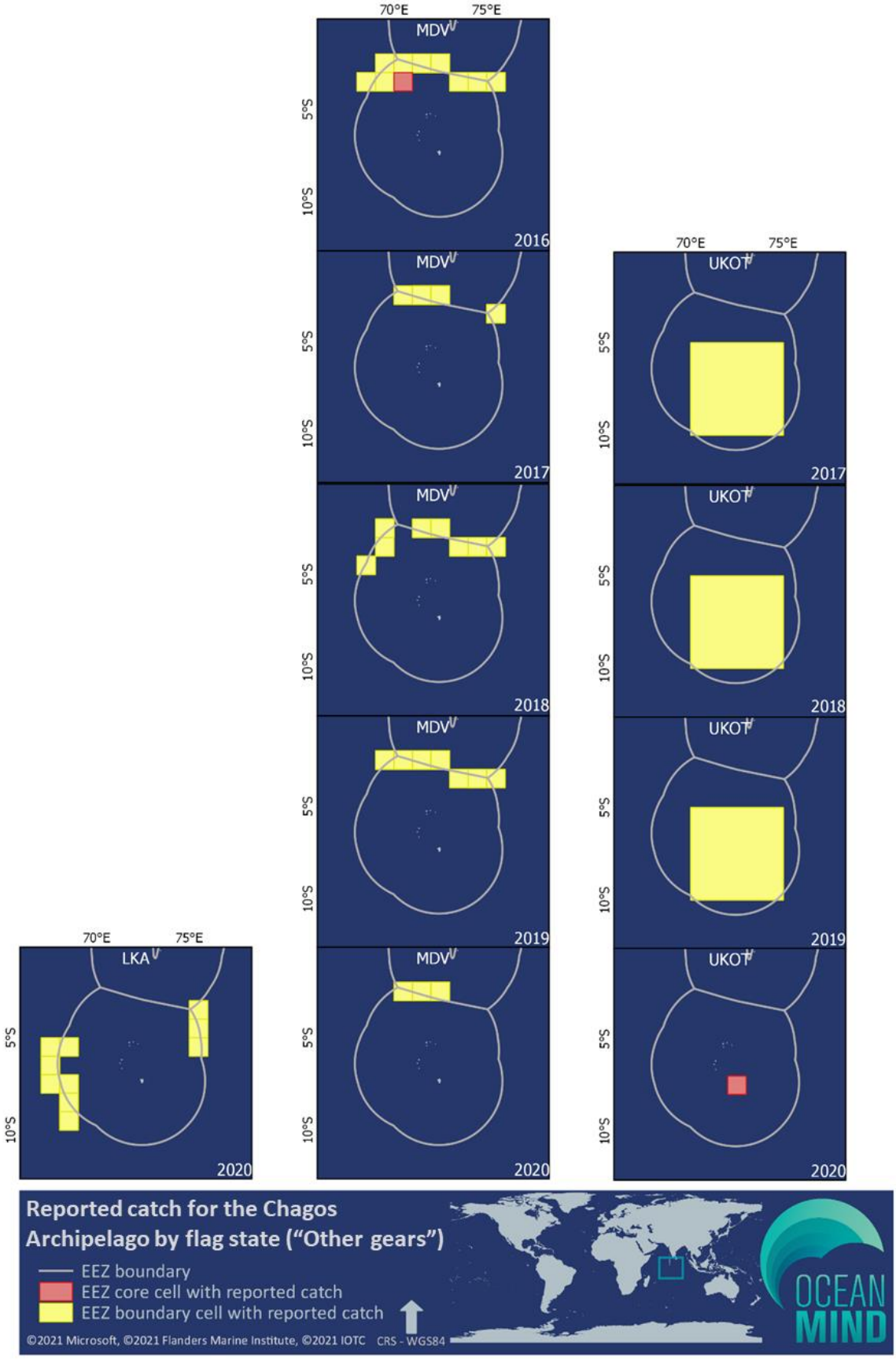


Figure 55: Location of LKA (Gillnet), MDV (Coastal LL, Handline) and UKOT(Handline) fishing effort associated with the Chagos Archipelago EEZ in 2017-2020

Table 25: Annual total effort and catch (metric tonnes) reported by Other gears within and along the boundary of the Chagos Archipelago EEZ for the period 2016-2020

Year	2016						2017						2018						2019						2020					
Location	EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary			EEZ			EEZ-boundary		
Effort months	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M	J	F	M
	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J	A	M	J
	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S	J	A	S
	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D	O	N	D
Flag State [Gear] *Reported effort* Total catch (metric tonnes)	**Maldives** [Coastal LL] *800 HOOKS* 0.11 MT			**Maldives** [Coastal LL] *107,944 HOOKS* 1,103 MT **Maldives** [Handline] *30 FDAYS* 43.28 MT						**Maldives** [Coastal LL] *29,176 HOOKS* 12.68 MT **Maldives** [Handline] *68 FDAYS* 65.24 MT **UKOT** [Handline] *10,247 DAYS* 26.81 MT						**Maldives** [Coastal LL] *60,496 HOOKS* 14.26 MT **Maldives** [Handline] *1 FDAYS* 0 MT **UKOT** [Handline] *9,871 DAYS* 23.02 MT						**Maldives** [Coastal LL] *94,032 HOOKS* 31.46 MT **Maldives** [Handline] *38 FDAYS* 22.74 MT **UKOT** [Handline] *11,791 DAYS* 17.93 MT			**UKOT** [Handline] *6,331 DAYS* 5 MT			**LKA** [Gillnet] *334 TRIPS* 811 MT **Maldives** [Handline] *27 FDAYS* 13.8 MT		

7 Conclusions

Multiple flag-states reported catch-effort for surface gears both along the boundary of, and within, coastal-state EEZs during the period 2016-2020. The publishing of catch-effort data at 1°x1° resolution in a gridded format does not permit the differentiation between catch-effort within and outside of EEZ boundaries, where a grid cell is positioned along a boundary. However, several flag-states have reported effort or catch-effort in grid cells entirely within EEZs, including in EEZs where no fishing effort should be expected, such as Chagos Archipelago. This may raise concerns for coastal-states which have no access agreements with the relevant flag-states for fishing inside their EEZs. Access to logbook data for accurate position of catch-effort and de-anonymising of catch data, together with VMS for ascertaining vessel position is potentially of use for coastal-states desiring to assess effort within their national boundaries.

Some uncertainty was raised by data reported by several flag-states, where considerable fishing effort was reported within or along EEZ boundaries, with corresponding catch that is significantly lower than expected. Examples include SYC reporting 65.39 FHOURS of purse seine fishing effort in the Tanzanian EEZ, while yielding 0 MT of catch (2020, Table 16), and EUFRA reporting 12.1 FHOURS of purse seine effort within the Somalia EEZ, yielding 0 MT total catch (2017, Table 13). Whether such occurrences are artefacts of T3, and similar models employed by flag-states, or are a true representation of fishing activity and yields is currently unclear.

Although there were few flag-states that reported fishing effort with gears other than purse seine and longline within and around the Chagos Archipelago EEZ, and this may be expected due to the prohibition of fishing inside the MPA, UKOT did report considerable fishing effort within the Chagos Archipelago EEZ in the period 2016-2020. It is unclear whether this effort is a valid representation of fishing effort using handlines in the Chagos Archipelago EEZ by UKOT.

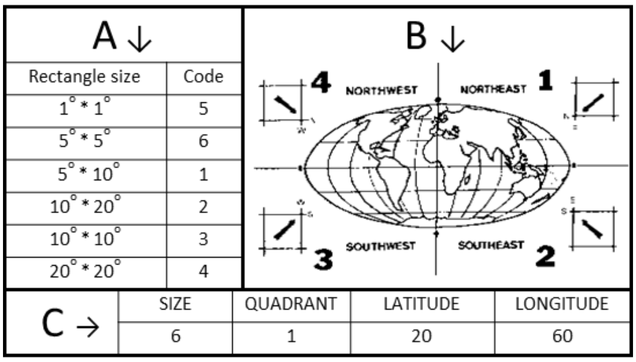
- It is recommended that coastal-states review fisheries access agreements for the period 2016-2020 against reported catch and effort by flag-states inside coastal-state EEZs.
- Where access agreements between coastal-states and flag-states were absent for the period 2016-2020, it is recommended that coastal-states request to the flag-states the identity of the vessels that reported these activities (either inside the EEZ or over the boundaries), VMS data, as well as copies of logbooks.
- It is recommended that clarification be sought regarding incidences of high effort being reported by flag-states, with low or zero corresponding total catch.
- It is recommended to seek clarification of the method for recording fishing effort in the Chagos Archipelago EEZ as reported by the UKOT flag-state, due to the very high annual effort apparent in the data

The International Convention for the Safety of Life at Sea (SOLAS) establishes that (Regulation 19 of SOLAS Chapter V) AIS must be fitted aboard all ships of 300 gross tonnage and upwards engaged on international voyages, all cargo ships of 500 gross tonnage and upwards regardless of where they operate and all passenger vessels. EU law relating to the fitting of AIS by fishing vessels and its subsequent maintenance in operation is Article 10 of EU Regulation 1224/2009, and Article 6a and Annex II, part I, of Directive 2002/59/EC relate to the fitting of AIS by fishing vessels and its subsequent maintenance in operation. Consequently, the apparent gaps in AIS transmission outside of the HRA for vessels from the EU flag states EU-Spain (Figure 38), EU-France (Figure 42) and EU-Italy (Figure 45), together with gap analysis at fleet level for these flag-states may be of concern. Due to the position of these transmission gaps, it is hard to entirely reconcile the patterns of AIS usage with the threat of piracy from the HRA. In addition, the distribution of catch-effort where no AIS transmissions at likely fishing speeds, including outside for the HRA, suggests vessel presence without corresponding AIS use for EU flag-states (Figures 35 and 37). In addition, although SYC and MUS are not subject to EU law, much of the SYC flagged purse seine remains under Spanish ownership. This point is perhaps even more compelling when considering the apparent similarities in AIS usage between EUESP and SYC purse seines operating in the western Indian Ocean.

- It is recommended for further investigation of the apparent low rate of AIS transmission by the relevant flag-states. Where possible, and where there is access to VMS data and logbook data of the vessels concerned, it is recommended that these data be analysed to indicate vessel location during periods of non-transmission on AIS.

8 Appendices

8.1 Appendix 1: IOTC grid system for catch-effort data

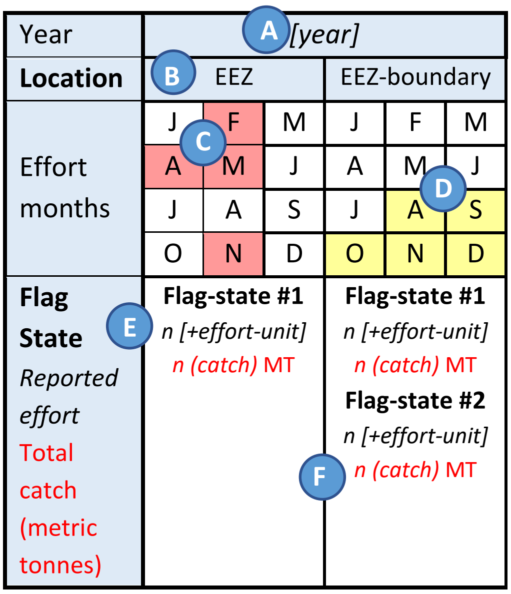


A: Size/resolution of grid cell and codes;

B: Major geographic quadrants;

C: Formatting of IOTC grid code. Adapted from source: https://www.iotc.org/documents/catches-and-effort-reference

8.2 Appendix 2: Purse seine catch-effort reporting format for coastal-states



A) Year for which annual totals were calculated.

B) Cell group.

C) Months where effort was reported in any cell situated entirely within EEZ boundaries.

D) Months where effort was reported in any cell situated along EEZ boundary.

*E) Annual effort per flag-state (in **bold**), grouped by effort unit within cell group.*

F) Annual total catch weight (metric tonnes) per flag-state within cell group (in red).

8.3 Appendix 3: Catch-effort 5°x5° degree resolution data, 2016-2019.

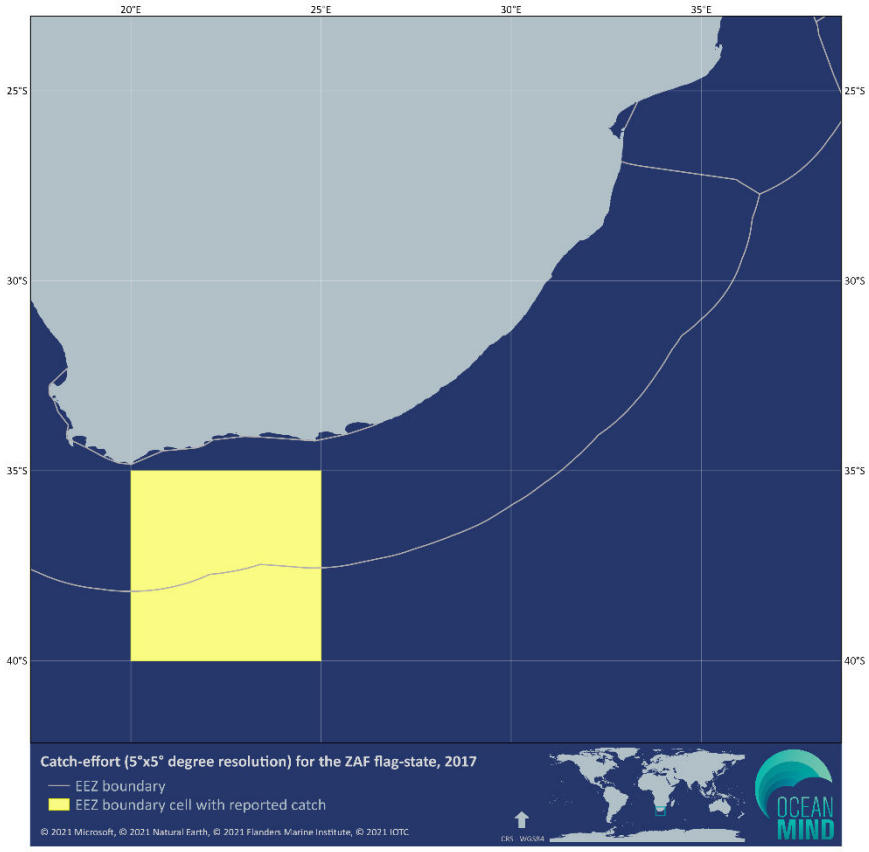


Figure A1: Geospatial location of catch-effort available at 5°x5° degree resolution for the ZAF fleet, 2017.

The flag-state ZAF (South Africa) reported catch-effort data at 5°x5° degree resolution for a grid cell covering the South African EEZ and adjoining high seas area in 2017 (Figure A1). ZAF reported total effort for the grid cell of 13 FHOURS, and catch of 1.04 MT.