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Situation Report: Southeast Pacific Distant Water Squid Fleet, June 2021

GFW-2021-FA-SQUID-JUNE2021

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Analysis Period: June 2021



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Summary - June, 2021

Global Fishing Watch in support of partnerships with coastal States in Latin America use remotely observed satellite data and artificial intelligence machine learning to better understand the extent and activity of the squid fleet operating in the Southeast Pacific during 2020 and 2021. Recently, Global Fishing Watch published a [2020 analysis report](#), which uses remotely observed satellite data and artificial intelligence machine learning to better understand the extent and activity of the squid fleet operating in the Southeast Pacific in 2020.

In order to improve transparency for the squid fleet and provide information to country partners, and stakeholders, Global Fishing Watch seeks to generate a series of periodic reports on the activity of the squid fleet in the Southeast Pacific for the year 2021. This series of reports will review the spatial and temporal distribution of the fleet, fishing effort, encounters, loitering event, and port visits, as well as the identification of a possible dark fleet.

The following are key highlights from June 2021:

- The squid fleet was mainly operating on the high seas an average of 470 nautical miles west of Ecuador's (Galápagos) exclusive economic zone. All the fishing vessels detected were flagged to China.
- Two vessels identified on AIS operating inside the Convention Area could not be matched to the South Pacific Regional Fisheries Organisation (SPRFMO) register of authorized vessels.
- One squid vessel was using two Maritime Mobile Service Identity numbers while transiting and fishing in the Southeast Pacific Ocean.
- Support vessels, after encountering squid vessels in the Convention Area, visited ports in four countries: Ecuador, Panama, Peru, and the Republic of Korea.

Number of vessels active in the area

- 298 squid fishing vessels
- 11 fish carriers
- 5 bunker vessels (tankers)

Main area of vessel activity

High seas 150 - 1500 nautical miles west of Ecuador's (Galápagos) exclusive economic zone

Total number of fishing days

5,227

Carrier vessel encounter events

189

Carrier vessel loitering events

331

Port visits

9

Average distance from the Ecuador's (Galápagos) exclusive economic zone

470 nautical miles

Situation Report: Southeast Pacific Distant Water Squid Fleet, June 2021

Overview

The jumbo flying squid (*Dosidicus gigas*) is the most abundant cephalopod species in the southeastern Pacific Ocean and one of the most important cephalopod fisheries in the world ([Ibáñez et al., 2015](#)). The range of this species extends from southern Chile to the North American coast ([FishSource](#)), falling within the remit of the South Pacific Regional Fisheries Management Organisation (SPRFMO), where it is the second largest fishery of this intergovernmental management body. This species is of clear socio-economic importance, both commercially on the high seas within the SPRFMO area and within the exclusive economic zones (EEZ) of Chile and Peru, as well as for small-scale fishers. In particular, in Peru where the squid fishery constitutes the largest artisanal fishery.

Using our public data and machine learning, Global Fishing Watch is investigating the activity of the squid fleet for June 2021. Our analysis draws on a combination of sources of information:

1. **Automatic identification system (AIS):**

AIS transmits a ship's position so that other ships are aware of its position. The International Maritime Organization (IMO) and other management bodies require large ships, including many commercial fishing vessels, to broadcast their position with AIS in order to avoid collisions.

2. **Visible infrared imaging radiometer suite (VIIRS):**

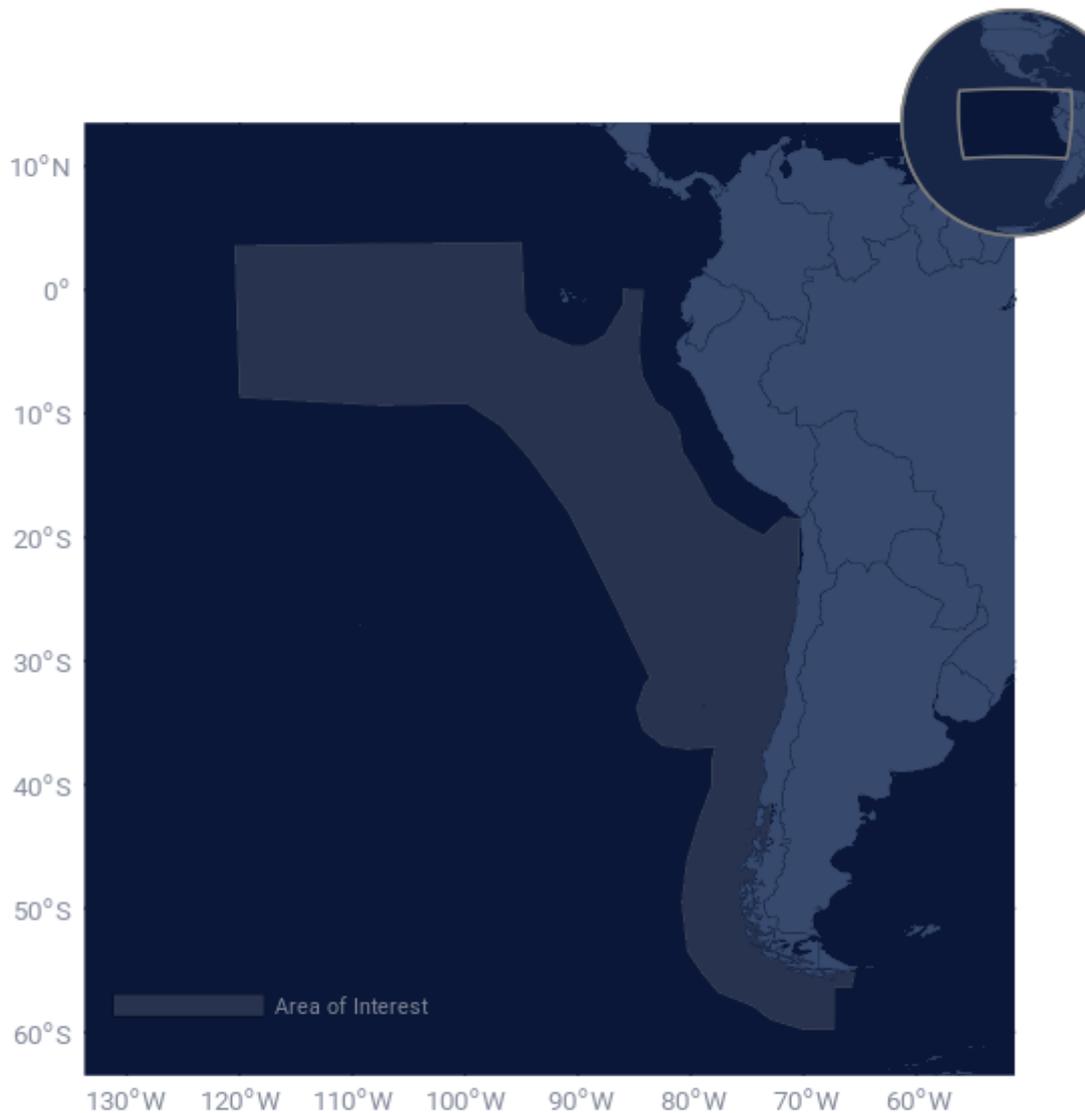
The Suomi National Polar-orbiting Partnership (NPP) satellite has a sensor with a spatial resolution of approximately 0.74 square kilometers, capable of detecting low light signals from the Earth. Called VIIRS, it is able to detect fishing vessels that use bright lights to attract target species to the surface such as the squid fishery in the eastern equatorial Pacific.

3. **SPRFMO registry**

According to the [CMM 05](#), Record of Vessels, the SPRFMO Commission established a register of fishing vessels which are authorised to fish in the SPRFMO Convention Area.

The analysis focuses on the area of interest (AOI) described below (Figure 1) during June 2021. This area was selected based on historic activity of the squid fleet in the region, in particular along Peru and Ecuador's (Galápagos) EEZ and an area on the equator about 1,500 nautical miles west of the Ecuadorian Galápagos' EEZ.

Figure 1: Area of Interest Within the Southeast Pacific Ocean



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Vessel tracking analysis

Using AIS data and the Global Fishing Watch fishing effort algorithm for night time squid fishing¹ a total of 295 unique Maritime Mobile Service Identification (MMSI) numbers completed an estimated total of 5,227 fishing days² over the month (Figure 2). In June, the fleet was mostly operating on the high seas between 150-1500 nautical miles west of Ecuador (Galápagos) EEZ. All the vessels are flagged to China. The status of the top 10 vessels detected in the AOI is

¹ Global Fishing Watch has developed algorithms to automatically detect different types of fishing activity from vessel tracking data. Kroodsma, D. *et al*, 2018. [Tracking the global footprint of fisheries](#). *Science*, 359 (6378), pp.904-908.

² This study considered a 'fishing day' as any 24-hour period where the Global Fishing Watch algorithm detected at least one hour of movements that were consistent with night time squid jigging.

summarized in Table 2. The number of AIS messages received per vessel operating inside the AOI in June varied significantly, ranging from 2 to 1,062 transmissions received.

Table 2: 10 most active squid fishing vessels operating in the Southeast Pacific during June 2021

Note: [Click to see the full list of vessels](#)³

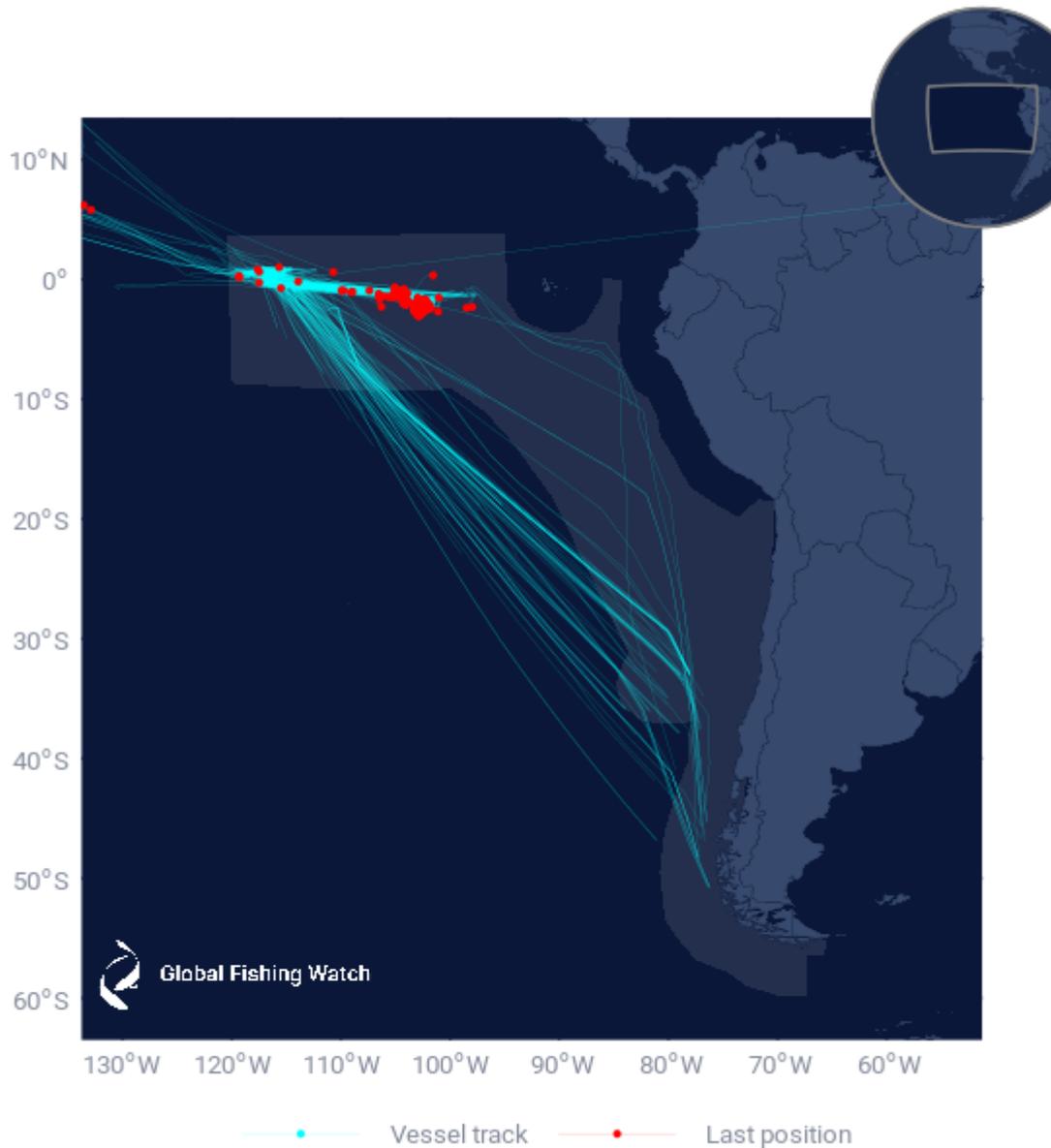
Vessel name	IMO	Fishing days ⁴	AIS positions	Flag*
SUYUANYU9	8782836	29	6630	China
PU YUAN 802	8779932	28	9827	China
ZHOUHONGYUAN7	8782783	28	23913	China
HUSHUNYU6	8774774	27	26469	China
NINGTAI21	8778706	27	24595	China
PUYUAN721	8528838	26	4317	China
LU RONG YUAN YU 610	9852896	26	2485	China
PUYUAN715	8528797	26	2447	China
JINHAI711	8779580	26	23940	China
GANGTAI1	9822700	26	2567	China

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³ https://docs.google.com/spreadsheets/d/1_5SNthDaxZoG5PI03vgujmYwF3T8XhLHEXv9VpSw030/edit#gid=1992095341

⁴ This study considered a 'fishing day' as any 24 hour period where the Global Fishing Watch algorithm detected at least one hour of movements that were consistent with night time squid jigging.

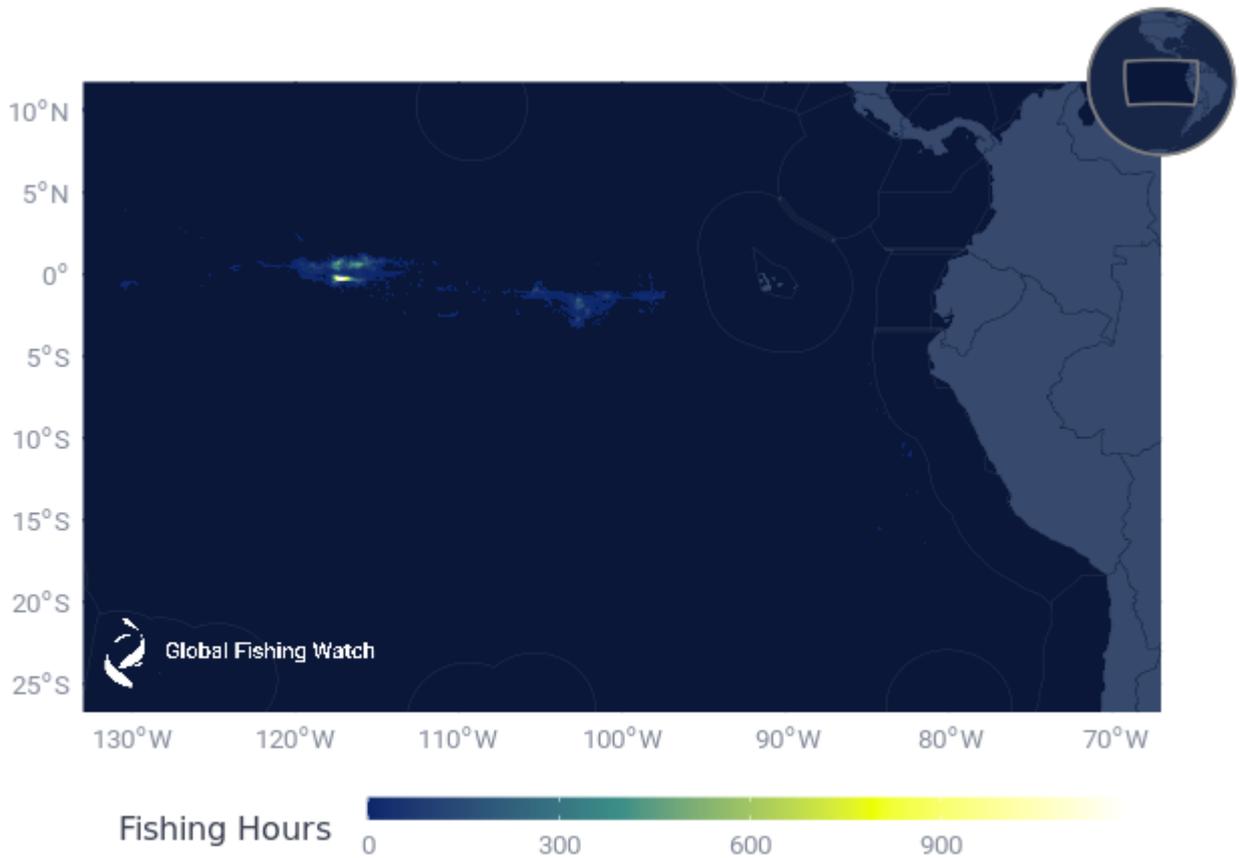
Figure 2: AIS-Detected Squid Vessel Activity During June 2021



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Red points in Figure above represent the last position of each fishing vessel. The blue lines represent the track of the vessels during June 2021. The blue lines, which start at the southern part of Chile's EEZ, show a fleet transiting from the South Atlantic Ocean to the Southeast Pacific Ocean. This finding is consistent with what was identified in the 2020 squid season report and aligns with what is known regarding the annual movements of the squid fleets between the Atlantic and Pacific oceans.

Figure 3: AIS-Detected Squid Fishing Effort During June 2021



© 2021 Global Fishing Watch

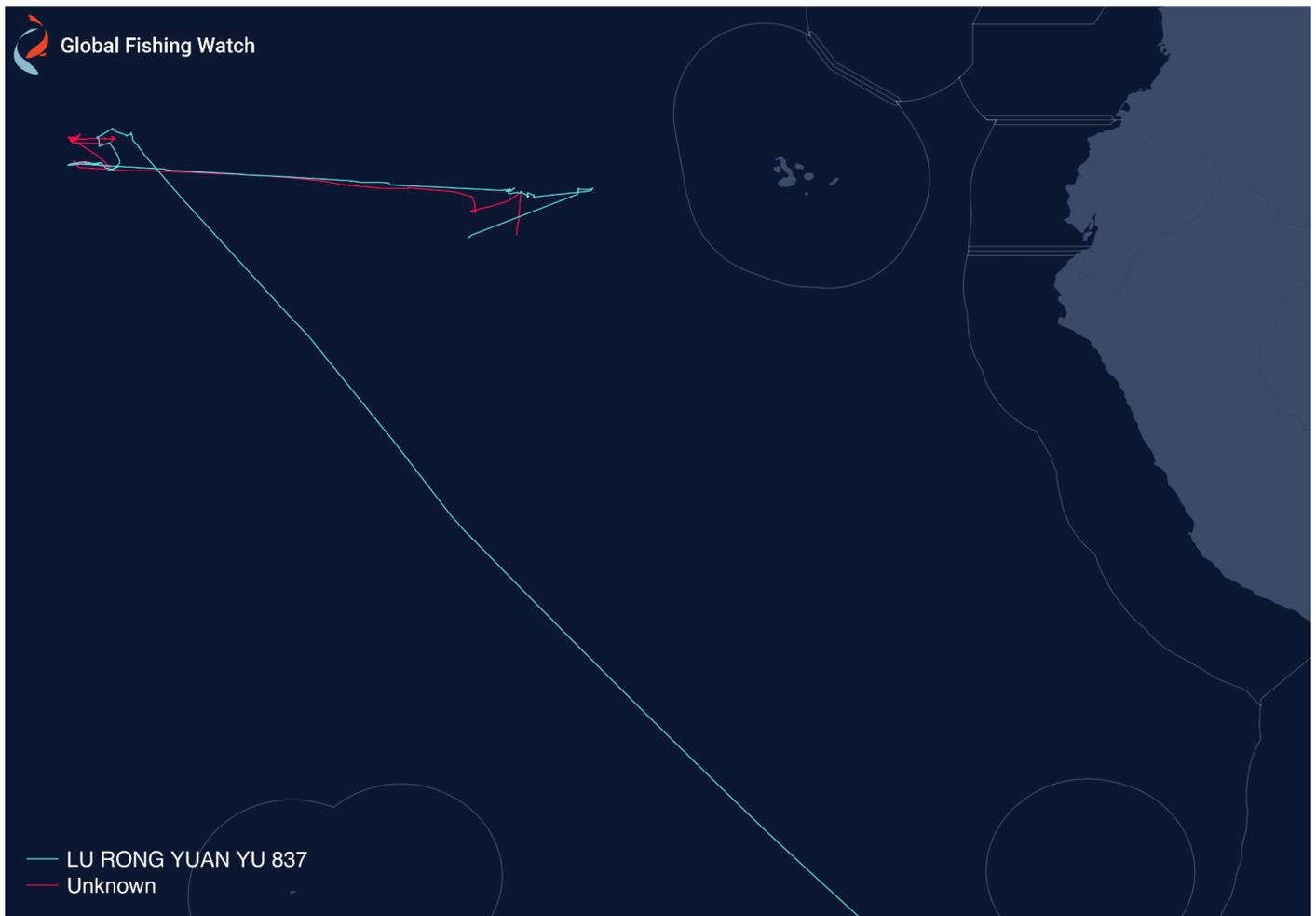
Unidentified vessels and vessel unmatched to a SPRFMO authorization

AIS identified two vessels active inside SPRFMO that could not be matched with an authorization to fish inside the Convention Area. The first vessel was broadcasting with the MMSI 135596865 and did not provide any identity information to allow a match. The second vessel with the MMSI 412549299 broadcast the name LU RONG YUAN YU 837 which cannot be found in the SPRFMO registry [database](#). Figure 4 displays both vessels' tracks, which were operating in the high seas west of Ecuador (Galápagos) EEZ.

Table 3: Vessels Not Matched to a SPRFMO Authorization

Vessel name	MMSI	callsign	IMO	Flag	SPRFMO authorization
Unknown	135596865	-	-	Unknown	Unidentified
LU RONG YUAN YU 837	412549299	BZVM9		CHN	Unmatched

Figure 4: Tracks of Unauthorized and Unidentified Vessels



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AIS misuse and irregularities

The AIS system was primarily designed for safe navigation and the avoidance of collisions at sea. Depending on the functionality of the device, some elements of the system can be tampered with, including changing the vessel identity information, changing the MMSI number, and some systems even appear to allow for the manipulation of a ship's position. Manipulation of AIS needs to be understood and Global Fishing Watch has established expertise to ensure that such manipulation is detected.

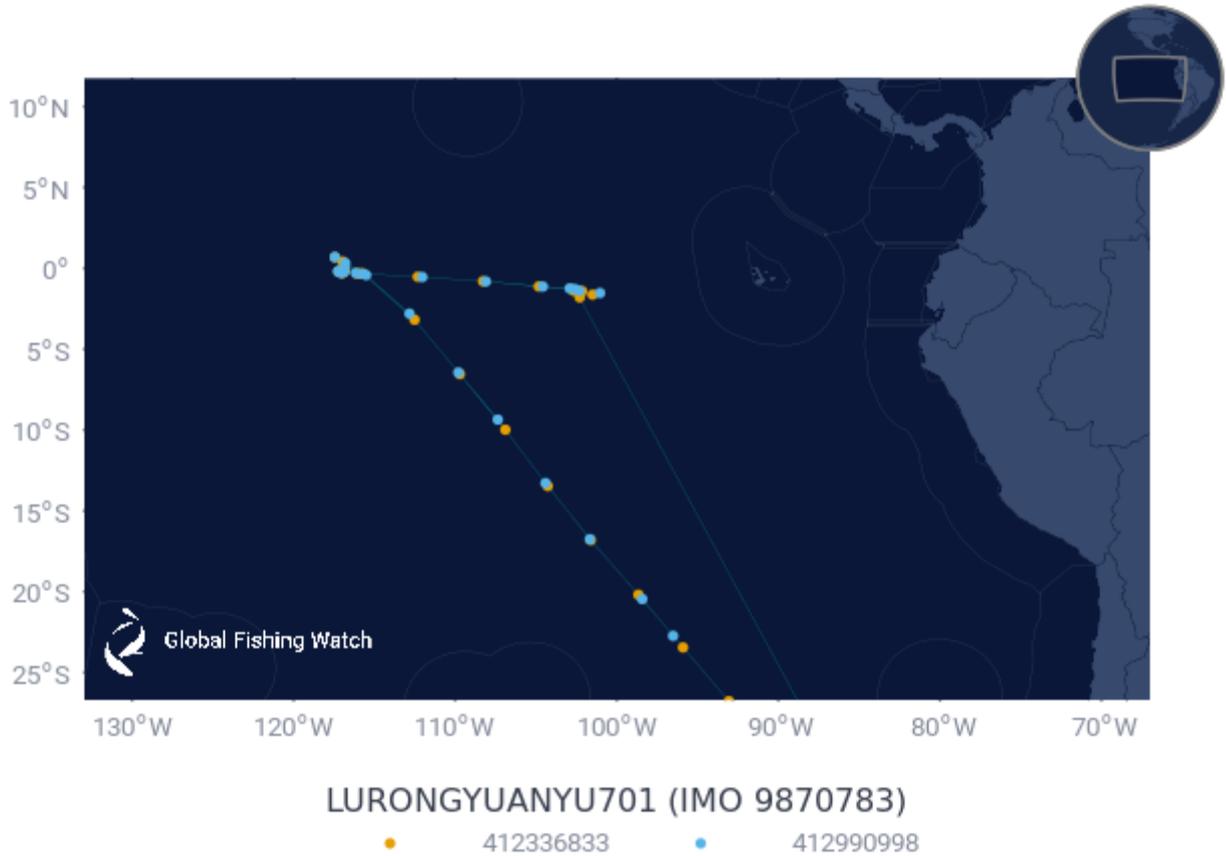
Vessels using multiple MMSI numbers

This type of irregularity happens when a vessel broadcasts its AIS location using two MMSI numbers; the MMSI number is unique for each vessel and the number should be assigned by the flag State. Consequently, operating a vessel with different numbers is irregular and potentially contravening IMO regulations and flag State rules on maritime radio licensing.

One squid vessel appears to be using two MMSI numbers. The [LURONGYUANYU701](#), authorized by the SPRFMO with IMO number 9870783 appears to be broadcasting with both MMSI 412336833 and 412990998.

It is unknown whether the discrepancies in MMSI numbers reflect different broadcasting devices, a satellite signal detection error or are simply a result of human error at the point of handling. The true reason behind vessels operating with multiple AIS devices, with different MMSI and identity information, is not clear; it does, however, highlight the real challenge of monitoring, control and surveillance of these vessels from remotely observed data.

Figure 5: Vessel Using Two MMSI Numbers



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Support vessels: Transshipment and bunkering

A large part of the business model for operating high seas fleets, like the southwest Pacific squid fleet, is that vessels are supported by refrigerated cargo vessels, often called carriers, and fuel tankers, which are commonly referred to as bunkering vessels.

Based on AIS data, we identified 16 support vessels operating within the AOI in June 2021—10 carrier vessels and 6 bunker vessels.

Table 4: 10 Most Active Support Vessels Operating in the Southeast Pacific Ocean

List of the top 10 non-fishing vessels operating in the Southeast Pacific region during 2020.

[Click to see the full list of vessels.](#)

Number	MMSI	Vessel name	Flag	Type
1	356802000	ANGEL106	PAN	Tanker
2	354003000	SHENJU	PAN	Fish carrier
3	372382000	OCEANRUBY	PAN	Tanker
4	356155000	TRITON REEFER	PAN	Fish carrier
5	351960000	MINGHANG5	PAN	Fish carrier
6	374245000	OCEANSPLENDID	PAN	Tanker
7	355827000	HAIFENG728	PAN	Fish carrier
8	636018227	WEI NING	LBR	Fish carrier
9	356470000	ANGEL101	PAN	Tanker
10	636019695	CHINA SPIRIT	LBR	Tanker

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Encounters and loitering events

Global Fishing Watch has developed data on two indicators for transshipment at sea, encounters and loitering events.

Encounters may indicate potential transshipment activity between two vessels that both appear to come together on AIS. Encounters are estimated using AIS data, including distance between the two vessels, vessel speeds, and duration in a given area.

Loitering is when a single vessel exhibits behavior indicative of a potential encounter event. Loitering is also estimated using AIS data, including vessel speed, duration in a given location, and distance from shore.

Analysis of the AIS data identified nine carriers and five tankers with encounters mostly Southeast outside the Galápagos EEZ (Figure 7). A total of 189 encounters were detected with squid fishing vessels in the AOI. Support vessels were flagged to three countries; China, Liberia, and Panama.

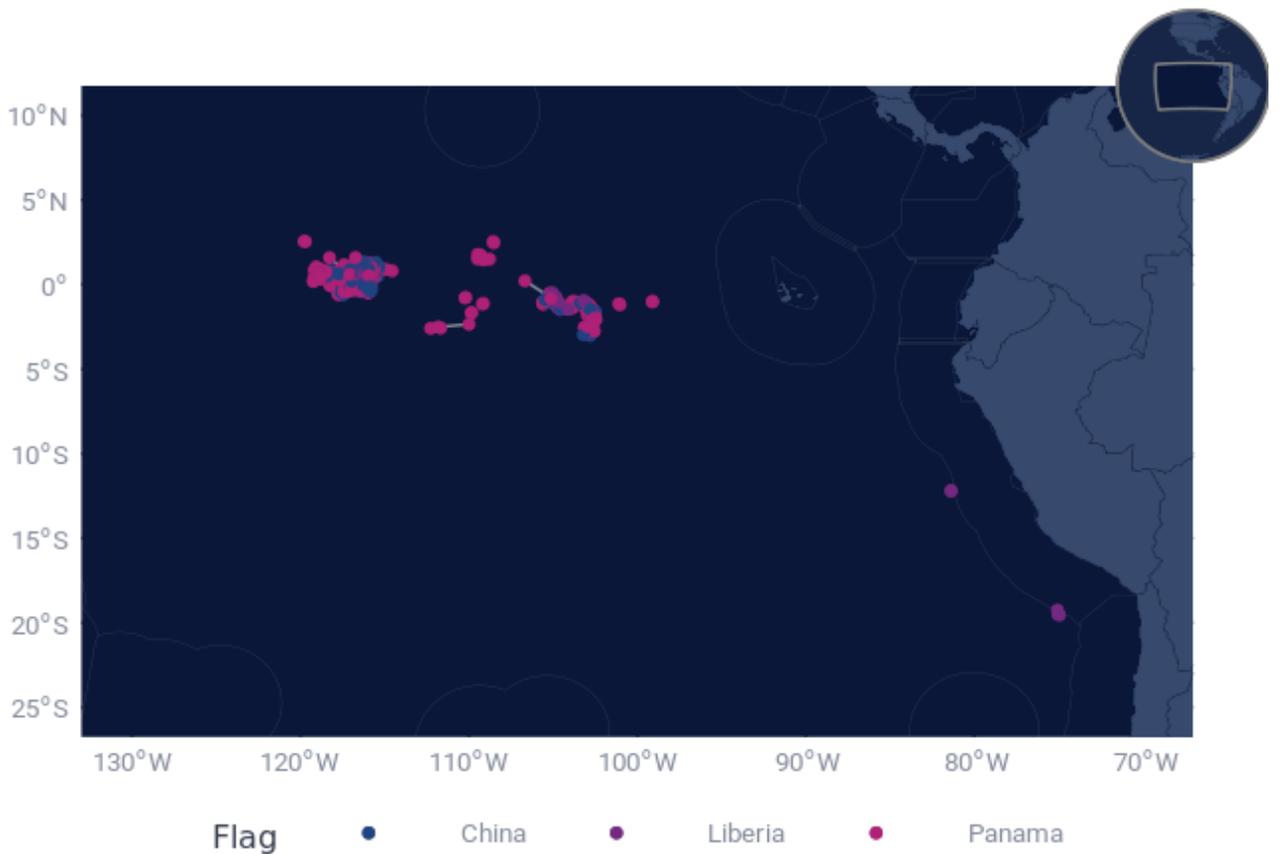
Fifteen non-fishing vessels had a total of 331 loitering events in the Southeast Pacific Ocean during June 2021 (Figure 8).

Figure 7: Distribution of Encounters by Support Vessels With Squid Vessels by Flag State



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Figure 8: Distribution of Loitering Events by Support Vessels by Flag State



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Encounters and loitering events by support vessels occurred in the key areas fishing vessels concentrated in June, figure 7 and 8 shows encounters and loitering events by carrier flag State. Each dot represents a possible transshipment event. See also [Global Fishing Watch Map - Carrier Vessel encounter analysis workspace](#)

Port visits

A total of eight port visits by carriers and tankers were identified from AIS in June 2021. Support vessels visited ports in four countries: Ecuador, Panama, Peru, and the Republic of Korea.

Table 7: Number of port visits per port and country by carriers and tankers

Port	Country	Number of port visits
Panama city	Panama	3
Colon	Panama	1
Callao	Peru	1
Busan	Republic of Korea	1
Puerto Bolivar	Ecuador	1
TXD	Ecuador	1

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Looking at the ‘dark fleet’

Analysis using AIS tracking is effective in providing a whole range of new insights and transparency on the activities of fleets like the high seas squid fleet. The challenge however remains that vessels are able to switch off AIS transmissions, rendering the vessel ‘dark’. In the absence of AIS, satellite-based remote sensing imagery can provide an additional source of information on the activity of fishing vessels that does not rely on tracking devices being switched on.

VIIRS image analysis

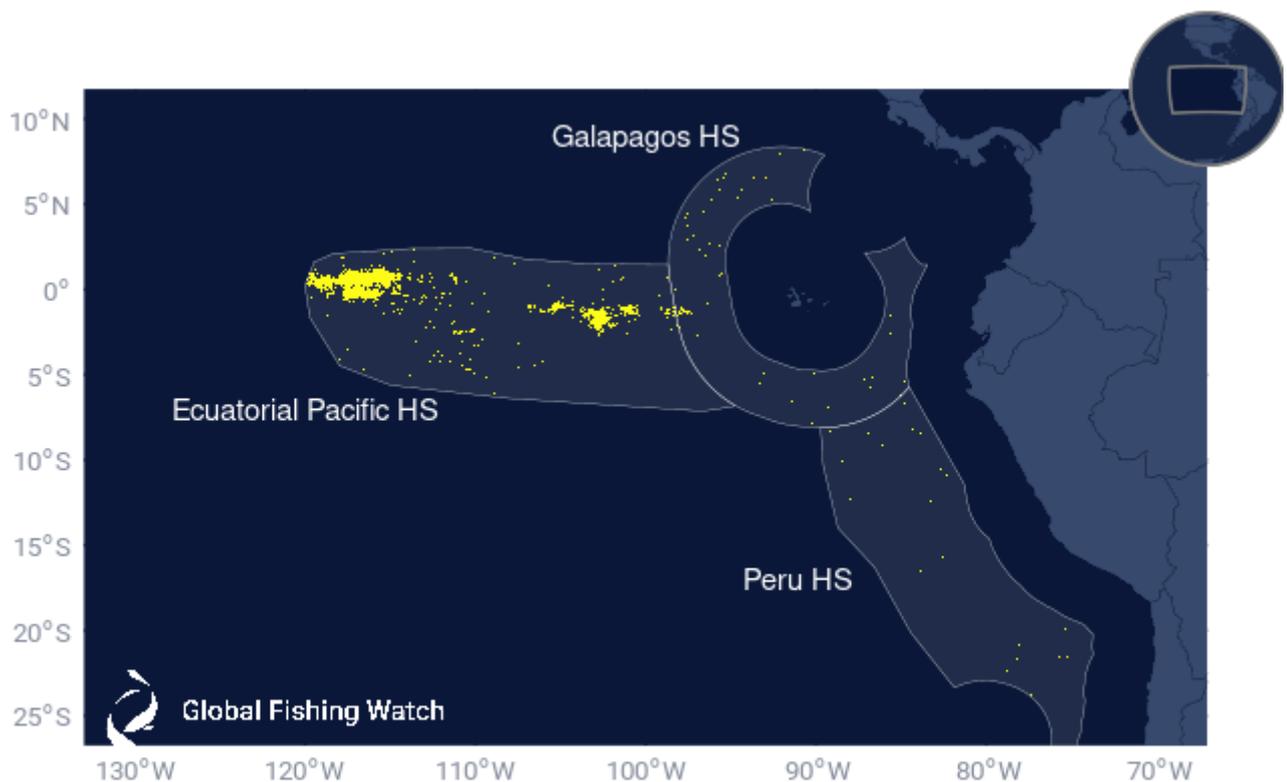
The Suomi National Polar-orbiting Partnership satellite has a sensor with a spatial resolution of approximately 0.74 square kilometers, capable of detecting low light signals from the Earth. Called the Visible Infrared Imaging Radiometer Suite (VIIRS) it is able to detect fishing vessels that use bright lights to attract target species to the surface such as the squid fishery in the eastern equatorial Pacific.

The analysis of AIS data shows no distant water vessels operating within any of the coastal States’ waters inside the study AOI in June 2021. To supplement the AIS analysis, VIIRS vessel detections were used to identify potential nighttime fishing incursions into the EEZs by large industrial squid vessels. No suspicious VIIRS detections were identified in June inside any coastal States’ EEZs.

Figure 10 shows the number of VIIRS detections as a bar graph for three areas of the study's AOI. The bars are split by whether or not detections were matched directly to AIS. The line graph overlaid represents the daily count of squid vessels transmitting on AIS. If the bars were greater than the line chart, it would indicate the existence of a 'dark fleet'. For these three regions the bars are less than the daily AIS count of squid vessels, suggesting a high proportion of the fleet is using AIS.

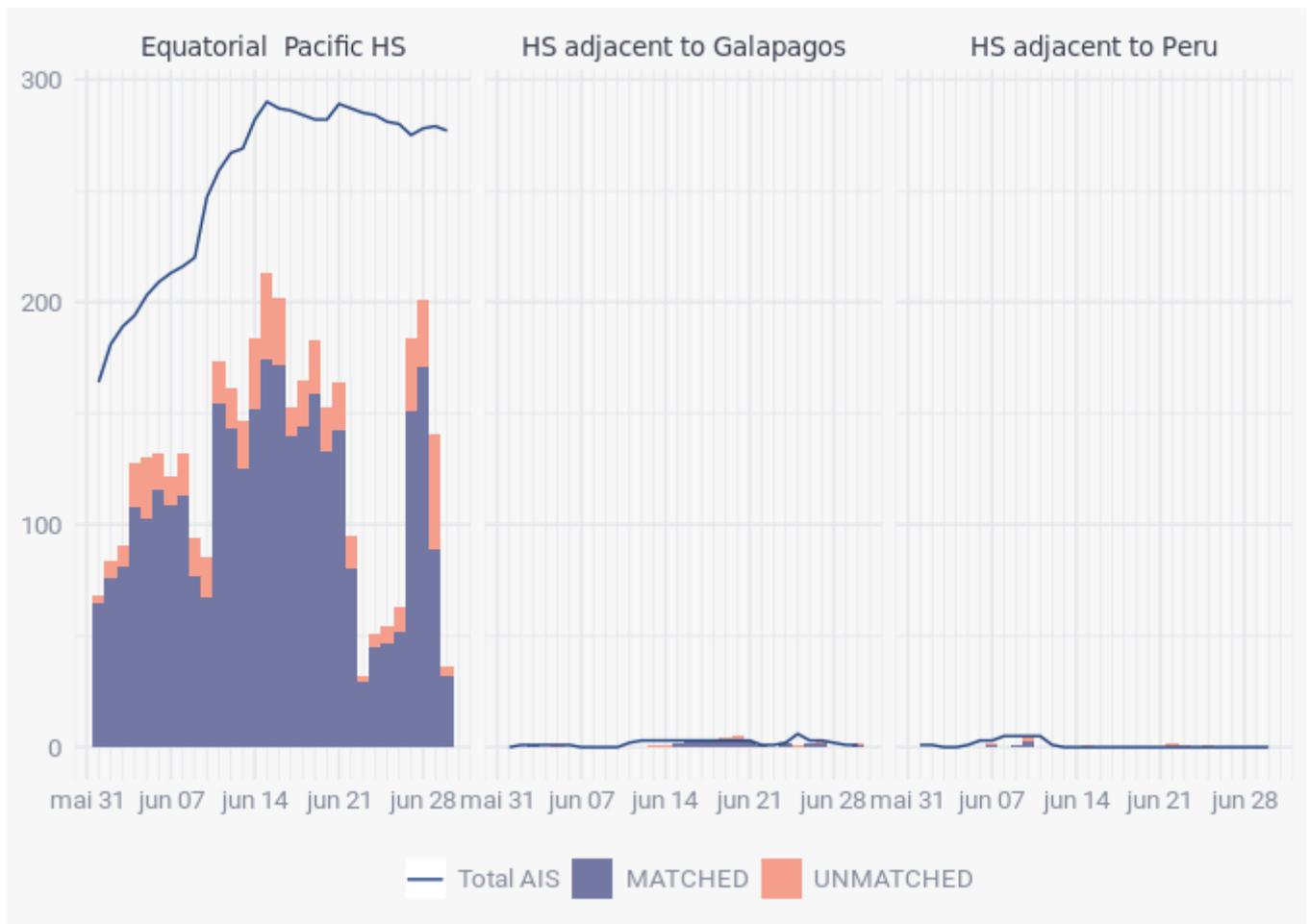
In the equatorial Pacific high seas area (around 1000 nautical miles west of Ecuador's (Galápagos) EEZ the most nighttime activity was identified by VIIRS, and the daily AIS count of squid vessels was actually higher than the VIIRS detections in all areas. This is likely the result of clouds obscuring the images or a very tightly packed fleet where multiple vessels are closer than the image resolution of 0.74 square kilometers and counted as a single vessel detection.

Figure 9: VIIRS Detection by Day, June 2021



Daily VIIRS detection for June 2021 over the main fishing squid areas, south of Galápagos and north and south of Peru. © 2021 Global Fishing Watch

Figure 10: Daily Count of VIIRS detection and Active AIS MMSI for Squid Vessels inside Area of Interest

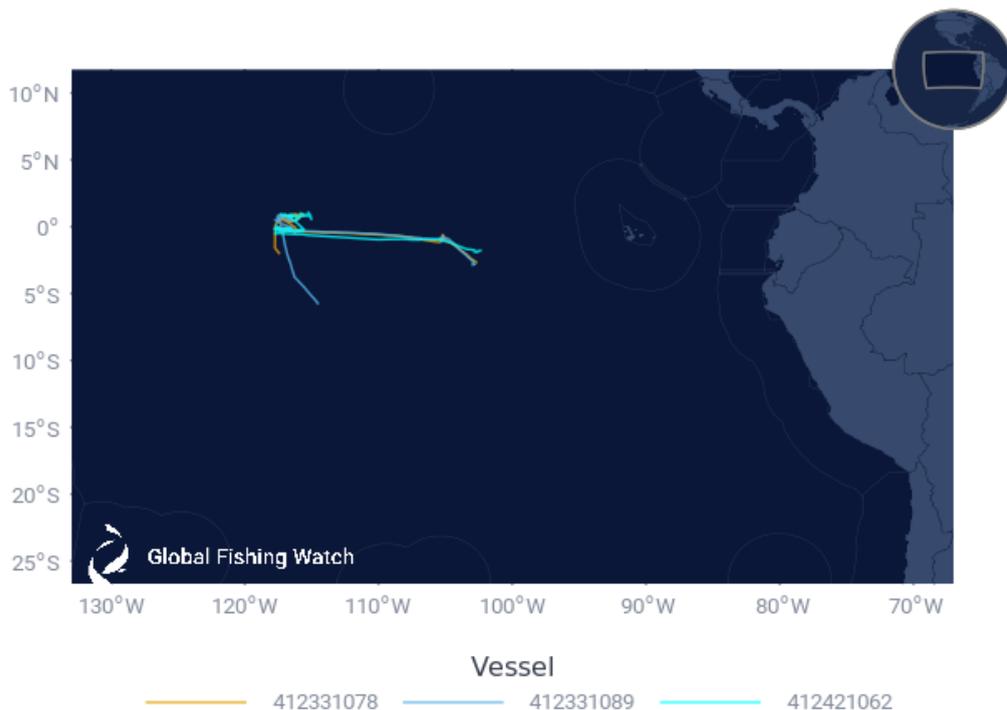


Note: HS refers to High seas
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Historic links to IUU fishing reports

Three squid fishing vessels identified as active in the AOI during June 2021 had previous records that were associated with illegal, unreported and unregulated (IUU) fishing events. Vessels are described in Table 8.

Figure 11: AIS Tracks of Vessels with Historical links IUU Fishing Reports



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Table 8: Vessels Identified with Links to Historic IUU Fishing Cases

ID	Vessel Name	MMSI	IMO	Flag	Type of fishery	SPRFMO List 2020	Date	Media report	AIS positions Jun 2021
1	LU RONG YUAN YU 688	412331078	8775883	China	Squid	Authorised	5/01/2020	Argentina	876
2	JING YUANG 626	412331089	9784568	China	Squid	Authorised	2/21/2018	Argentina	11437
3	HUA XIANG 801	412421062	9822695	China	Squid	Authorised	3/19/2020	Argentina	2855

IUU historical list for three 3 vessels registered and authorized by the SPRFMOq related to IUU fishing activities from 2018 to 2020. © 2021 Global Fishing Watch

Conclusions

The analysis identified two vessels that could not be matched to a SPRFMO authorization which, if confirmed, would indicate a degree of unregulated squid fishing, albeit small. Additionally, three vessels with previous IUU-related historic events were identified. This finding can help alert port States to conduct the appropriate inspections.

AIS data can increase the transparency of the squid fishery in the Southeast Pacific and can be used by flag and coastal States to support monitoring control and surveillance of the fishery. It is recommended States cross check the AIS data with reported information from fishing and carrier vessels to help ensure vessels are correctly authorised and reporting catch inline with SPRFMO CMMs.

Annex 1 - Caveats & Disclaimer

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AIS provides the only open source monitoring tool for high seas fishing. AIS relies on voluntary transmission, and is restricted to the vessels which have AIS devices installed and operating, making the data records incomplete. An additional source of uncertainty in AIS-based data relates to poor satellite reception, in areas with high vessel traffic, such as the South China Sea and English Channel. That said, the reception is generally good in the focal area of this report, however, the boats operating within the squid fishery often use Class B AIS transponders that broadcast at a lower rate when the vessels move slower than two knots. The majority of squid vessels fish by drifting with the currents⁵ at a speed less than two knots, therefore the AIS messages received by these vessels and estimates surrounding their AIS-based fishing effort will be conservative. Nevertheless, in the absence of any other information, these data can be used to characterize the spatial extent and relative activity of the squid fleet in the area. This report was completed by manual review of AIS data and may differ to the information displayed in our automated [public map](#) or [carrier vessel portal](#).

'Encounter Events' are identified when AIS data indicates that two vessels may have conducted a transshipment, based on the movements of the two vessels. Global Fishing Watch identifies encounters from AIS data as locations where two vessels, a carrier and fishing vessel, were within 500 meters for at least two hours and traveling at a median speed less than 2 knots, while at least 10 kilometers from a coastal anchorage.

'Loitering Events' is when a single vessel exhibits behavior indicative of a potential encounter event. Loitering is estimated using AIS data, including vessel speed, duration in a given location, and distance from shore. Loitering occurs when a carrier vessel travels at average speed of < 2 knots, while at least an average of 20 nautical miles from shore. It is possible that loitering events do not indicate a potential transshipment, but another event in which a vessel may remain fairly steady, including maintenance or waiting outside of port for permission to dock.

⁵ Taconet, M., Kroodsmas, D., & Fernandes, J.A. 2019. Global Atlas of AIS-based fishing activity - Challenges and opportunities. Rome, FAO. page 352. <http://www.fao.org/3/ca7012en/CA7012EN.pdf>

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Global Fishing Watch is an international nonprofit organization dedicated to advancing ocean governance through increased transparency of human activity at sea. By creating and publicly sharing map visualizations, data and analysis tools, we aim to enable scientific research and transform the way our ocean is managed. We believe human activity at sea should be public knowledge in order to safeguard the global ocean for the common good of all.

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