



Global Fishing Watch

**A Comparative Analysis of AIS Data with the
International Commission for the Conservation of Atlantic Tunas
Reported Transshipment Activity in 2018**

Acknowledgements

This report was funded in part by the Gordon and Betty Moore Foundation and produced in cooperation with The Pew Charitable Trusts (“Pew”). The authors would like to thank Mark Young, Executive Director of the International Monitoring, Control, and Surveillance (IMCS) Network, and Claire van der Geest for reviewing this study.



Prepared by: Global Fishing Watch

2018 AIS-Detected Transshipment Activity in the International Commission for the Conservation of Atlantic Tunas Convention Area

Transshipment of catch at-sea is a major part of the global fishing industry, particularly the tuna sector. However, existing monitoring and regulatory controls over transshipment at-sea are widely considered [insufficient](#), with no guarantee that all transfers are being reported or observed in accordance with Regional Fisheries Management Organizations (RFMOs) Conservation and Management Measures (CMMs). Ineffective and/or incomplete monitoring, control and surveillance (MCS) of at-sea transshipment creates opportunities for illegally caught seafood to enter the supply chain, and may perpetuate human rights abuses aboard vessels and provide an enabling environment for other illicit activities.

To help increase the transparency and understanding of at-sea transshipment activities, Global Fishing Watch (GFW), in partnership with The Pew Charitable Trusts (Pew), is undertaking an [assessment](#) of at-sea transshipment activities occurring inside the Convention Areas of the five global tuna RFMOs. Together, GFW and Pew have also launched the Carrier Vessel Portal (CVP). The first of its kind, the CVP is a publicly facing tool focused on at-sea transshipment, that seeks to provide policymakers, authorities, fleet operators, and other fisheries stakeholders information on when and where at-sea transshipment activities are taking place. The CVP uses commercially available satellite Automatic Identification System (AIS) data, combined with machine learning technology and publicly available information provided by RFMO's, including registry data to identify and display information on potential transshipment activity.

Utilising the CVP, Pew and GFW are producing a series of annual reports that compare at-sea transshipment-related activities observable through AIS data with publicly available information generated from RFMO member implementation of the relevant at-sea transshipment CMM. These reports are designed to be RFMO-specific and cover calendar years 2017 through 2019.

These reports assess the activity of carrier vessels and provide indication of possible transshipment events by comparing AIS data of vessels and determining possible "encounters" and "loitering" events. 'Encounter Events' are identified when AIS data indicates that two vessels may have conducted a transshipment, based on the distance between the two vessels, duration the vessels operated in close proximity, and vessel speeds. 'Loitering Events' are identified when a single carrier vessel exhibits vessel movements consistent with encountering another vessel at sea, but no second vessel is visible on AIS, also known as a 'dark vessel'. Loitering events are estimated using AIS data to determine vessel speed, duration at a slow speed and distance from shore.

Note: AIS data is only one dataset and additional information available to RFMO Secretariats, RFMO members, and flag States is needed to provide a complete understanding of any apparent non-compliant or unauthorized fishing activity identified within this report. Only after investigation by the Secretariat or relevant flag and coastal State authorities should that determination be made and appropriate enforcement or regulatory action taken.

For more information on the data used in this study, or to request the data annex, please contact carrier-vessel-portal-support@globalfishingwatch.org.

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List of Acronyms

AIS – Automatic Identification System
ICCAT – International Commission for the Conservation of Atlantic Tunas
CMM – Conservation and Management Measure
CPC - Contracting Party, Cooperating non-Contracting Party, Entity or Fishing Entity
CVP – Carrier Vessel Portal
EEZ – Exclusive Economic Zone
GFW – Global Fishing Watch
IUU – Illegal, Unreported, Unregulated
LSTLV – Large-Scale Tuna Longline Vessels
MCS – Monitoring, Control and Surveillance
PSMA – Port State Measures Agreement
RFMO – Regional Fisheries Management Organization
ROP – Regional Observer Program
VMS – Vessel Monitoring System

This report also refers to UN ISO 3166-1 alpha-3 country codes which can be found here for reference <https://unstats.un.org/unsd/tradekb/knowledgebase/country-code>.

Executive Summary

Transshipment in the International Commission for the Conservation of Atlantic Tunas (hereinafter referred to as the “ICCAT Convention Area”) is currently regulated by Gen Rec 16-15 *Recommendation by ICCAT on Transshipment*. This recommendation includes reporting requirements for both fishing and carriers to help deter Illegal, Unreported, and Unregulated (IUU) fishing activities and better manage the fishery. Additionally, this Recommendation requires that all carriers transshipping ICCAT managed species are authorized by ICCAT and must carry an ICCAT observer at all times. The [Recommendation](#) acknowledges the need for greater monitoring, control and surveillance (MCS) of vessel activity and transshipments due to *'...grave concern that... a significant amount of catches by IUU fishing vessels have been transshipped under the names of duly licensed fishing vessels...'*.

Last year, GFW submitted a [report](#) to the 26th Regular Meeting of the Commission, in which commercially available Automatic Identification System (AIS) data was used to analyze the track histories of carriers operating within the ICCAT Convention Area during the calendar year 2017. This year, GFW analyzed carrier vessel activity in the Convention Area during calendar year 2018, to further investigate potential risk of non-compliance and trends in carrier vessel activity over time. This report looks at the effectiveness of the ICCAT Recommendation on Transshipment and considers what additional measures might be required to better monitor and control transshipment activity and detect and deter unauthorized transshipments or transfers of IUU-related catch sourced from the ICCAT Convention Area.

The ICCAT Regional Observer Program (ROP) for carriers is one of the most transparent observer programs amongst the tuna RFMOs. Included in the ROP reports are geolocations and dates of each observed at-sea transshipment conducted by carriers and longliners within the Convention Area. This level of transparency around activities at sea allows members to conduct due diligence and validate that reported information on their flagged vessels is consistent with what is reported by the ROP. This welcome level of transparency in reporting ensures more effective governance over transshipment at-sea within the ICCAT Convention Area, and reduces the risk that illegally caught or unreported fish enter the supply chain. The ROP could be further improved by the standardization of reporting requirements and additional detail in the submitted reports which would reduce the likelihood of discrepancies between the ROP reported information and the ICCAT ROP summary documents .

However, even with the high levels of transparency included in the ROP report, there was one CPC-flagged carrier, not identified in the ROP report, which was seen conducting AIS-detected encounters with longline vessels within the Convention Area. Additionally, there were discrepancies in the information provided by the [ROP Observer Reports](#) and the ICCAT ROP summary documents (Doc. No. PWG 402/2018 and Doc. No. PWG 402/2019). Not all ports visited by carriers after encounters with longliners were located within ICCAT member States, meaning they were not designated as ports of entry under the ICCAT Port State Measures Recommendation 18-09. This unobserved activity both at-sea and in-port increases the risk of

non-compliance to ICCAT transshipment management measures. ICCAT should consider the following recommendations to improve the Recommendation on Transshipment, and further reduce the risk of IUU fishing activities within the Convention Area.

Finding	Recommendation
<ul style="list-style-type: none"> ● ICCAT has one of the most transparent carrier vessel ROPs of all tuna RFMOs, though reported information can be inconsistent 	<ul style="list-style-type: none"> ● Standardize the amount and type of information required from the ROP, and ensure consistency in reported information.
<ul style="list-style-type: none"> ● Carrier vessel trips/encounters were conducted outside of the scope of the ROP. 	<ul style="list-style-type: none"> ● Investigate potential transshipment activity which was not reported on by the ROP. ● Require all active carriers conducting transshipments within the Convention Area to provide up to date information regarding flag State.
<ul style="list-style-type: none"> ● There were a high number of loitering events vs encounters. 	<ul style="list-style-type: none"> ● Implement a centralized VMS to ensure effective oversight of carrier and fishing vessel activities. ● Expand the current ICCAT Recommendation on Transshipment requirement of CPCs and the ROP to record and report any encounters unrelated to the transfer of fish occurring within the ICCAT Convention Area.
<ul style="list-style-type: none"> ● Encounters were detected on the high seas just outside EEZs after longline vessels were observed fishing within those EEZs. 	<ul style="list-style-type: none"> ● Ensure that fish transferred outside of EEZs are effectively monitored and reported to relevant authorities by establishing MoUs with non-CPC port States.
<ul style="list-style-type: none"> ● There were a high number of port visits to Porto Grande, Cape Verde, and the purpose of these visits is unknown. 	<ul style="list-style-type: none"> ● Require ROP observers to report on non-transshipment port activity, such as transfers and offloading of crew and equipment, and refueling, during ROP observed voyages.

- carriers visited non-CPC ports after encounters with longline vessels.

- Ensure compliance with General Recommendation 18-09 on Port State Measures requiring use of ICCAT designated ports by carriers when offloading transshipped catch.
- Encourage port authorities in non-CPC port States to share landing declarations at ports used by carriers when landing ICCAT caught species.

Activity overview

Regional Observer Program (ROP)

ICCAT's ROP transshipment reports are among the most transparent of all five global tuna RFMOs. With the observer reports also made publicly available, the data provided by ICCAT suggest a welcome level of carrier vessel transparency that, if used alongside open source tracking data or, even better, a centralized VMS, could support the appropriate governance and oversight of transshipment activity at sea. However, more uniformity and consistency in ROP data reported, both in units used and better precision in observer reports, would increase the ability for GFW to conduct a full and accurate analysis of transshipment activity in comparison to AIS detected vessel activity.

GFW was able to estimate matches¹ between the observer reported transshipments in 2018 and AIS-detected data using vessel identify, location, and time. Approximately 75% of the AIS-detected encounters and 63% of the AIS-detected loitering events matched reported transshipments per documented ROP trip. In Figure 1 below, ROP reported transshipments have been overlaid with the GFW AIS detected encounter and loitering events. There is a strong spatial alignment between them. This correlation highlights how useful AIS data is as a tool for identifying potential transshipments. There were instances where AIS detected events, especially loitering events, where no transshipment activity was reported through the ROP. Although based purely on carrier track behavior, they indicate a possible transshipment may have occurred in which the fishing vessel was not transmitting AIS. Even though not all ROP reported transshipments matched an AIS-detected event, all of the ROP reported trips can be seen on AIS within the GFW Carrier Vessel Portal (CVP) and can be examined further by interested parties. The data annex provides the matching rates for each voyage.

¹ A matched encounter is defined as an encounter event within 12 hours and 10 kilometers of a reported transshipment event. A matched loitering event is defined as within 12 hours and 5 kilometers of a reported transshipment event. The matching algorithm is stricter as loitering events are less well defined than encounter events. For the purposes of this report only reported ROP at-sea transshipments of fish were matched to AIS-detected data.

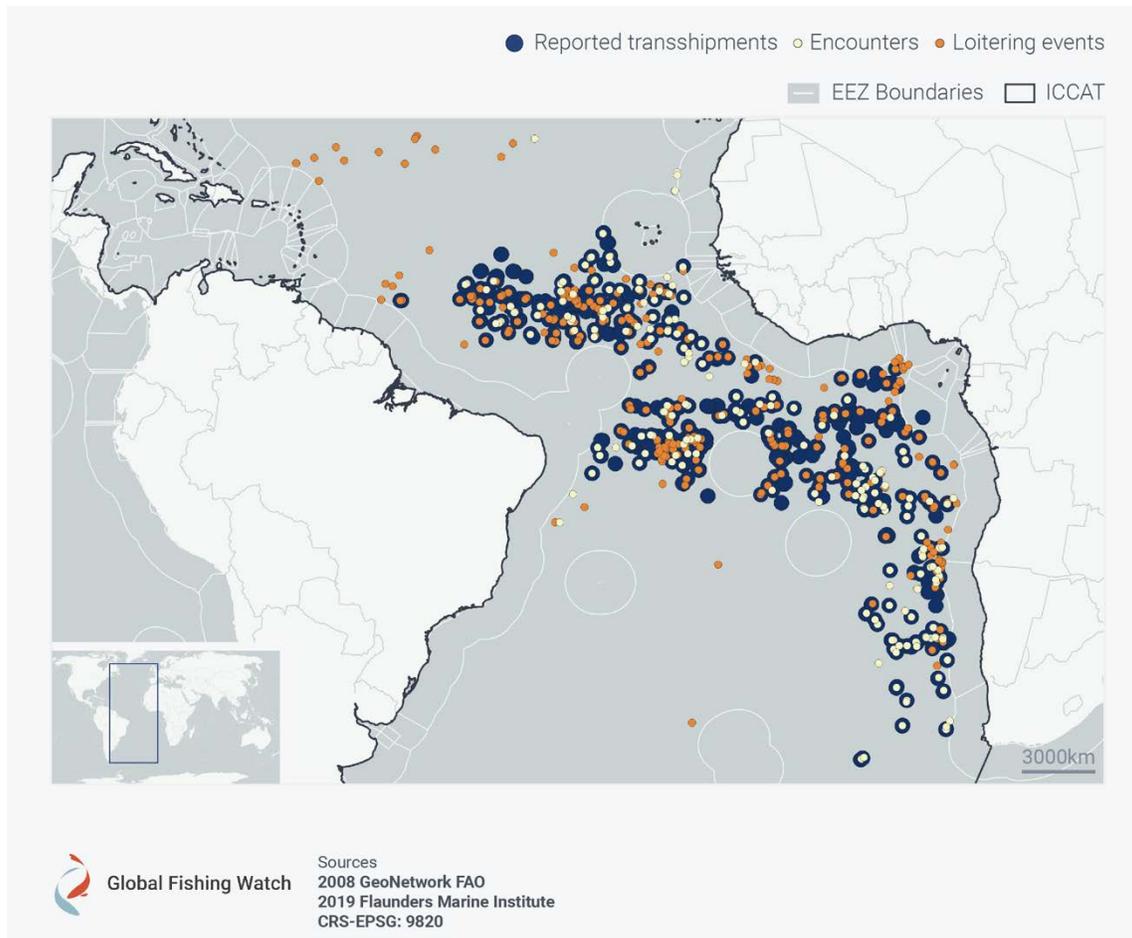


Figure 1. Reported transshipments overlaid with GFW AIS-Detected encounter and loitering events

Discrepancies between the number of reported transshipments and the number of encounters and loitering events detected via AIS are due to the limits of AIS, constraints of the encounter and loitering event definitions, and inconsistencies and inaccuracies in the detail provided in the ICCAT observer reports. While the ICCAT ROP is robust in the amount of information presented, there are inconsistencies in the precision and formatting of the data, specifically the transshipment location (latitude and longitude) provided, which GFW uses to match the event and can impact the matching rate. For instance, although the observer trip 222 is reported in table 2 in [Doc. No. PWG_402/2019](#), the actual observer report with the individually documented transshipments appeared to be missing and consequently was unable to be matched to AIS data.

AIS Activity Overview

Encounters

GFW identified 1,586 events conducted by carriers operating on the high seas in the ICCAT Convention Area in 2018. Of these, 465 were encounters with identified fishing vessels, and 1,121 were loitering events that did not match an encounter event (Figure 2).

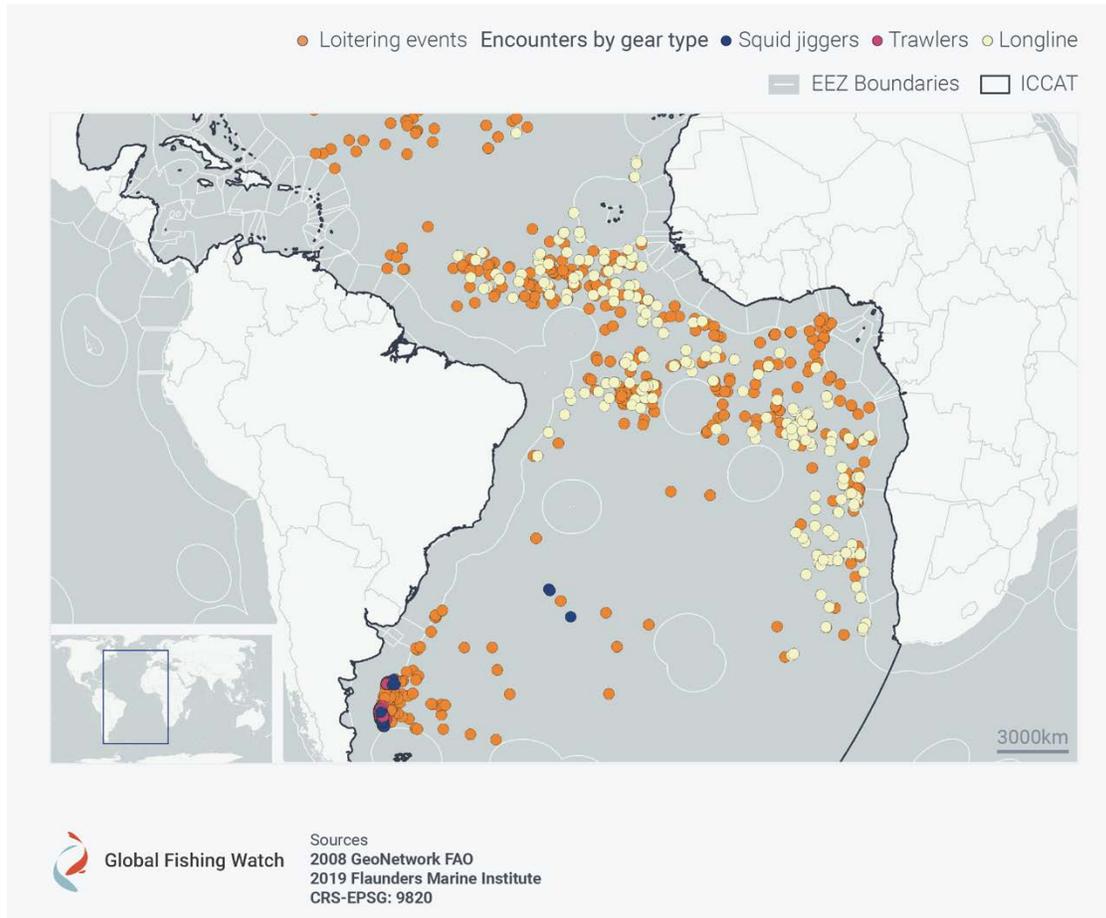


Figure 2. Potential transshipment events, including loitering and encounter events in the ICCAT Convention Area.

ICCAT Convention waters are home to a variety of different fisheries. For example, 136 encounters with squid jiggers in 2018 make up nearly a third (29.2%) of all AIS detected encounters by carriers. For the purposes of this report, further analysis of encounters on the high seas was restricted to the 211 encounters that involved a longline fishing vessel most likely to have been associated with capture of ICCAT managed species (Figure 2). In each of these encounters, the carriers and longline vessels involved were flagged to ICCAT Contracting Parties and/or Cooperating Non-Contracting Parties (collectively “CPCs”) (Figure 3).

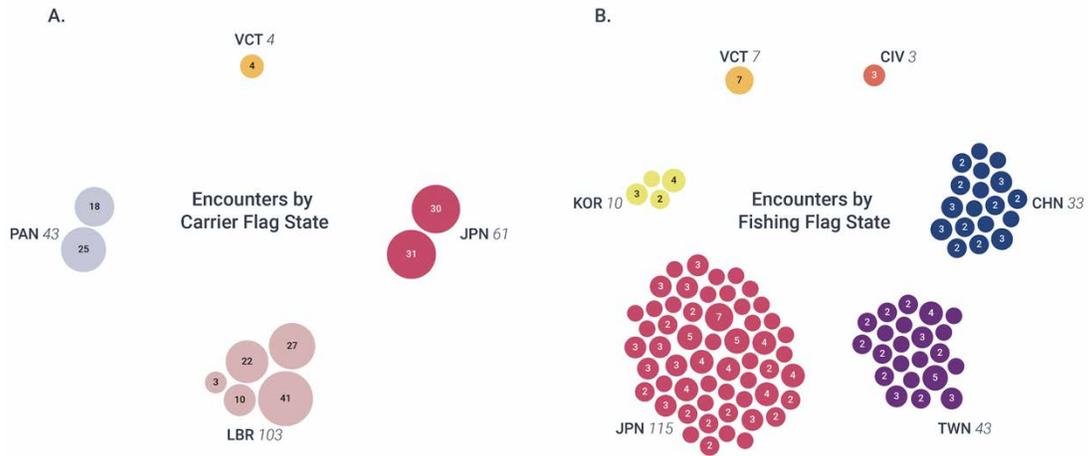


Figure 3. A. GFW-detected Encounter Events by Carrier Flag State and B. Fishing vessel Flag State. *Note: bubbles indicate unique carriers*

Each of the AIS-detected encounters with longline fishing vessels were conducted during carrier vessel trips which were reported on by the ICCAT ROP. The ROP reported nine voyages by Liberian flagged vessels in 2018, seven by Japanese flagged vessels, and four by Panamanian flagged vessels. These same trips were documented using GFW data (Figure 4). However, ICCAT reported a total of 648 transshipments, while GFW detected 439 potential transshipments (encounter and loitering events) on these same trips. GFW may have detected fewer potential transshipments because of restrictions in the encounter and loitering algorithms. However, the AIS data provides additional information that cannot be obtained from the ROP. For instance, GFW detected a carrier vessel trip which included four encounters and eight loitering events which did not appear in the ROP report (Figures 4 and 5).

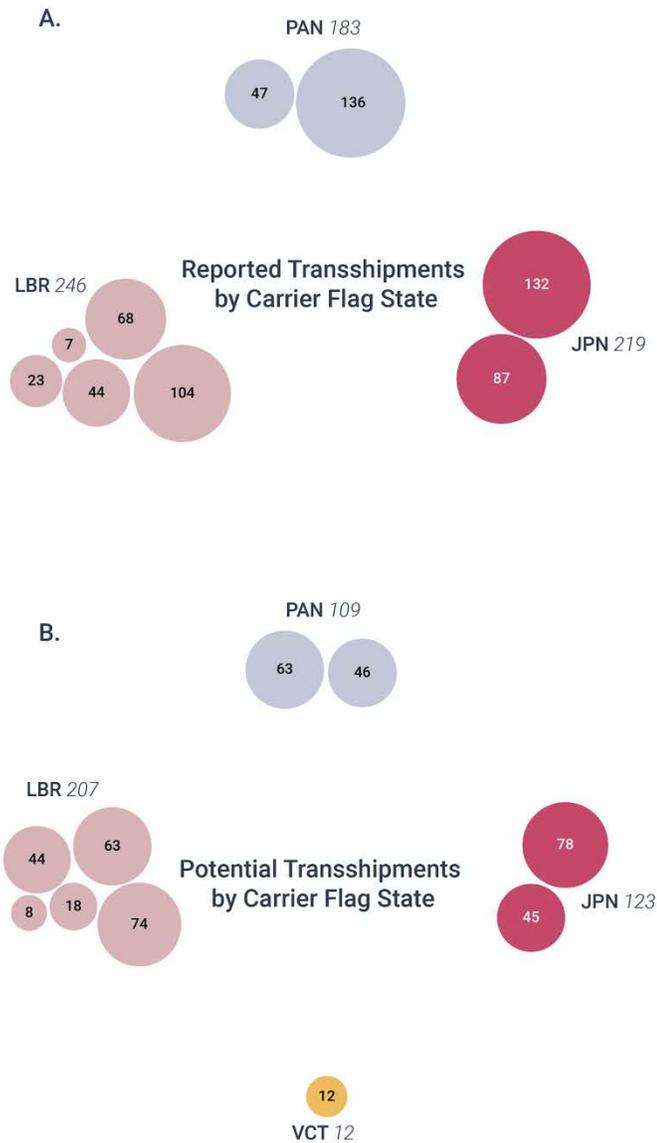


Figure 4. A. Reported Transshipments by Carrier Flag State. B. GFW AIS-Detected Potential Transshipments by Carrier Flag State. *Note: bubbles indicate unique carriers*

This trip was conducted by a carrier flagged to Saint Vincent and the Grenadines, a flag State red carded by the EU in 2017². According to the [FAO](https://www.fao.org/), since 2017 the vessel does not appear to be authorized, and is considered to have inactive authorization based on public [ICCAT records](https://www.iccat.org/). Furthermore, the detected encounters by this carrier were conducted with a single longline

² <https://www.seafoodsource.com/news/environment-sustainability/comoros-saint-vincent-and-the-grenadines-given-red-card-by-european-commission>

vessel also flagged to Saint Vincent and the Grenadines. According to the International Maritime Organization, midway through 2018, the carrier vessel changed flags to “unknown” flag before engaging in an additional encounter with the same longline vessel and more loitering events. This vessel’s activity should be of interest to the Compliance Committee.

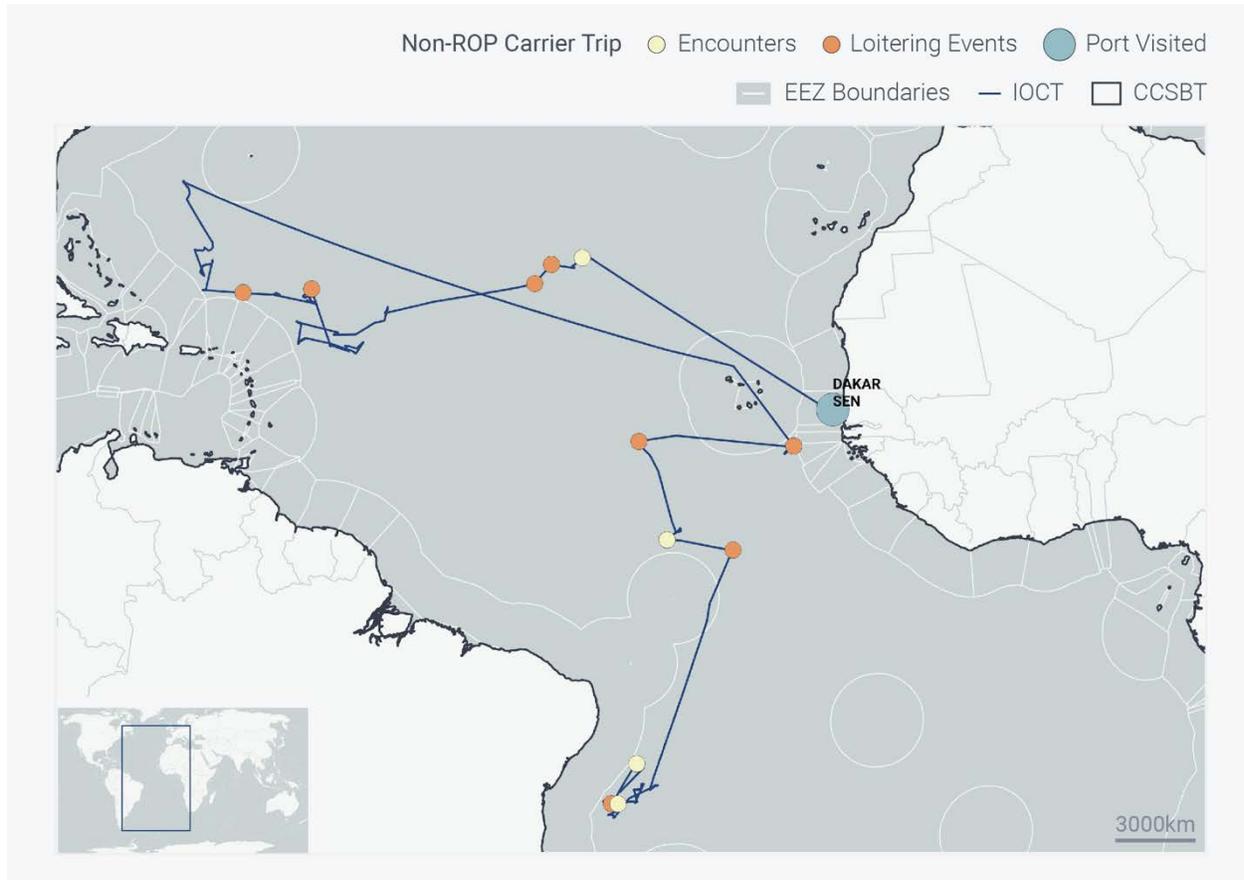


Figure 5. Track history of the VCT flagged carrier vessel that did not report to the ROP

Loitering events

When analyzing AIS data for potential transshipments at sea, there are generally many more loitering events observed than there are encounter events. This is due to a variety of factors. Primarily, because the definition of a loitering event is less restrictive and only dependent on the AIS transmission of a single vessel. Additionally, some fishing vessels transmit on class B AIS, which has inconsistent satellite reception. GFW algorithms detected 1,121 loitering events by carriers on the high seas of the Convention Area in 2018. These loitering events did not overlap with any encounters.

As highlighted in Figure 1 above these loitering events can be indicative of, but not proof of, transshipment. Not all these events will be transshipment of fish, and some may be associated

with other at-sea activities like mechanical issues and waiting for port access. In cases where they do indicate an encounter with a fishing vessel, this may be related to the transfer of bait, food or other bunkering, but it also may indicate that activity at sea may go unobserved. In 2018, there were significantly more loitering events inside the ICCAT Convention Area than encounters on the high seas, but also specifically within EEZs of coastal States. It is recommended that electronic monitoring (EM) of carriers is adopted alongside VMS to reduce the risk of unauthorized transshipments inside the Convention Area, particularly in the waters of coastal States.

High Seas Loitering Events

To estimate loitering events which are more likely to indicate a transshipment related to the transfer of ICCAT managed species, GFW removed loitering events conducted by carriers which had encounters with non-longline vessels from the analysis. The events were further narrowed down to include only those which occurred within the latitudinal boundaries in which encounters with longline vessels had also been observed. This resulted in 301 loitering events likely related to an ICCAT transshipment. Of these, 70 were conducted by a carrier that did not carry an ICCAT ROP observer, or were conducted during a voyage that did not appear in the ROP report (Figure 6).

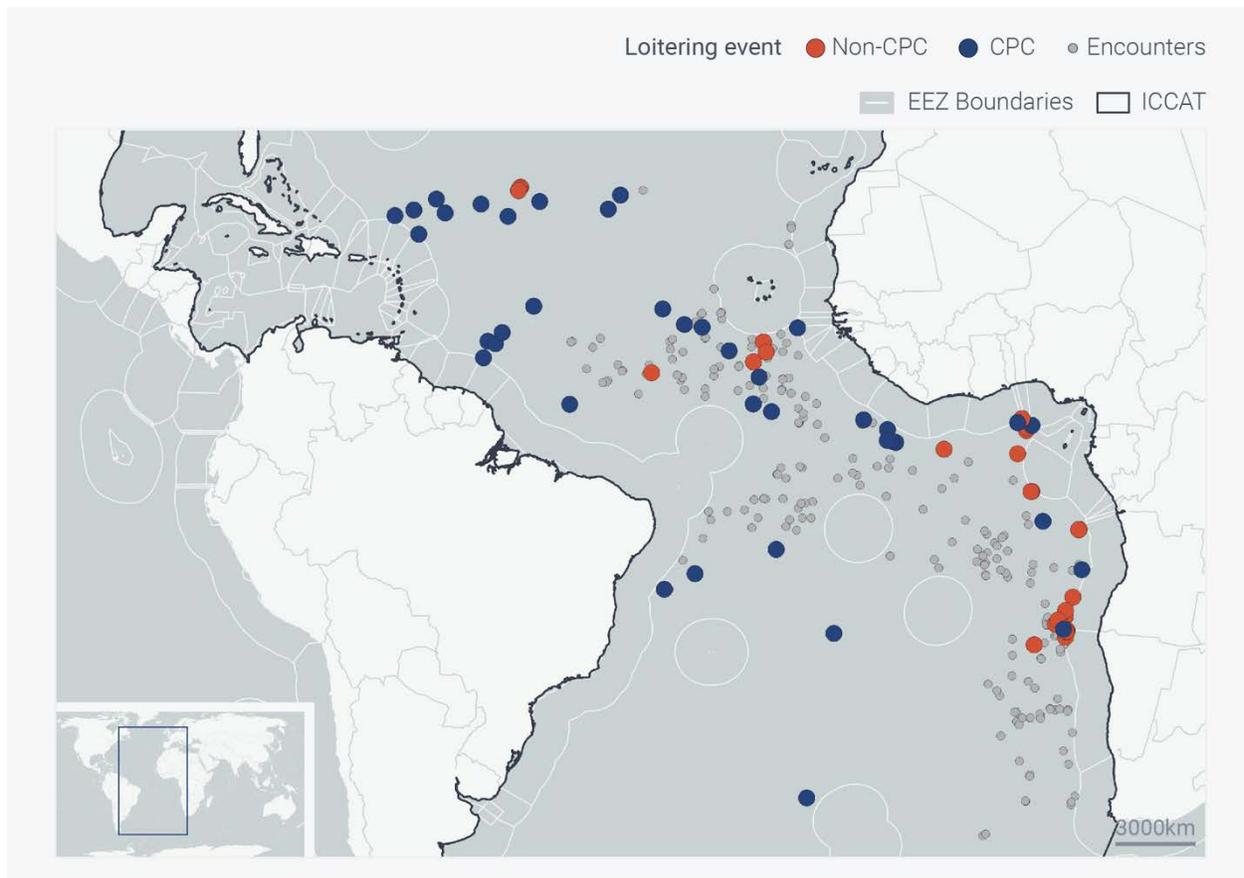


Figure 6. Loitering events that did not occur during ROP reported vessel trips by both Non-CPC (red) flagged carriers and CPC (blue) flagged carriers.

The 301 loitering events were conducted by 48 carriers from 16 flag States. The 13 Liberian flagged carriers were involved in 115 of the events, followed by the 11 carriers flagged to Panama (78 events) and the two carriers flagged to Japan (62 events). Almost all of the events (271, or 90%) were conducted by 34 carriers flagged to ICCAT CPCs. The remaining 30 events were conducted by 14 carriers flagged to non-CPCs (Figure 7).

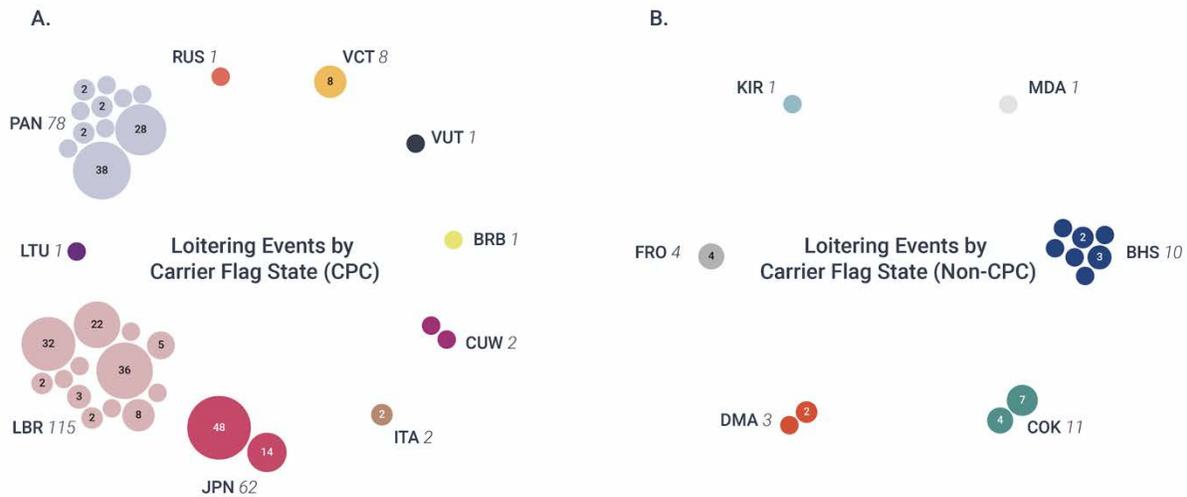


Figure 7. A. Loitering events by CPC Carrier Flag State and B. Non-CPC Carrier Flag State

EEZ - Loitering Events

GFW detected a higher number of loitering events within EEZs than on the high seas. There were a total of 929 loitering events detected inside EEZs. Within the same latitudinal bounds, only six encounters between carrier and fishing vessels were detected, and these encounters were with trawler fishing vessels (Figure 9). This activity should be of interest to ICCAT and its member States because of the risks associated with unreported transshipments that can impact coastal States licensing revenue and resources.

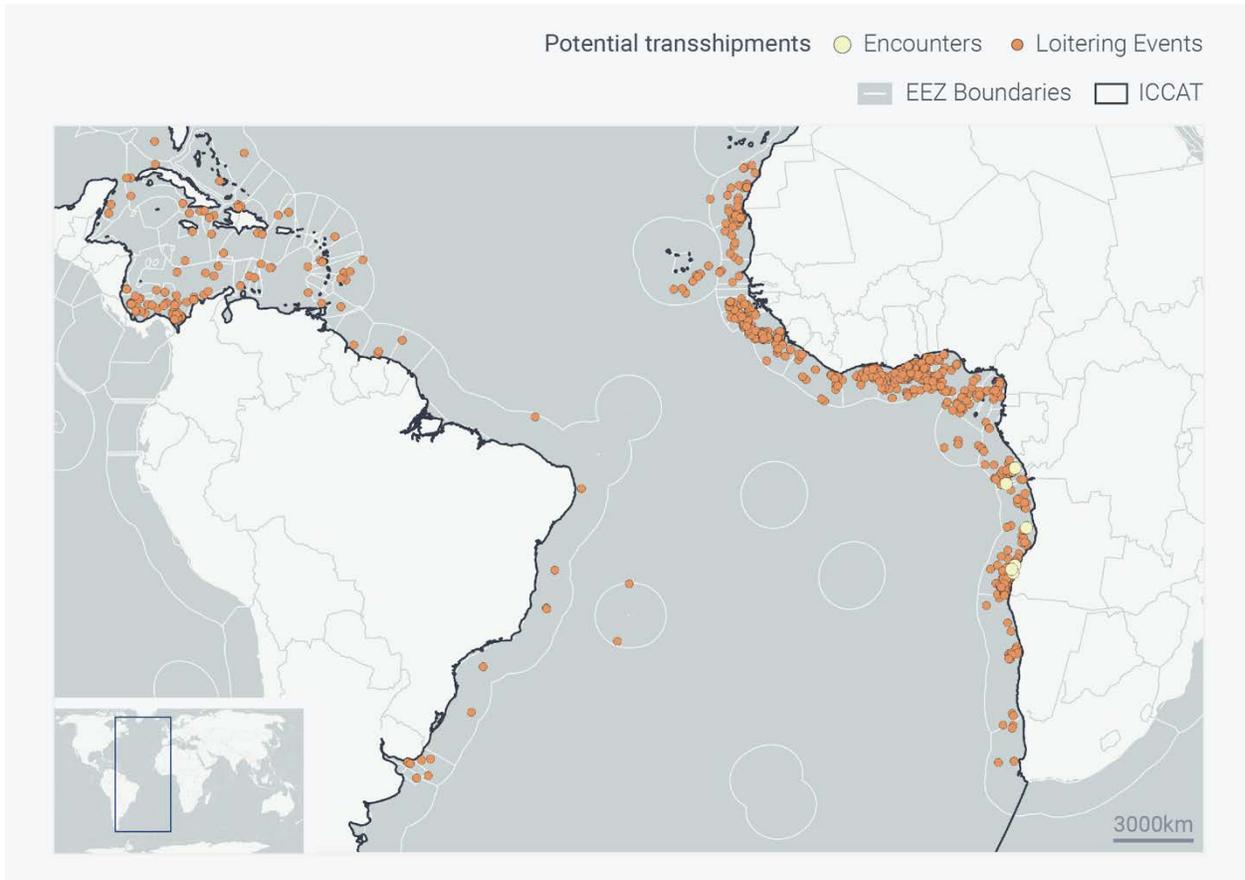


Figure 9. Loitering and encounter events detected inside EEZs within the latitudinal bounds of ICCAT high-seas potential transshipments

Of the 929 loitering events, 773 (83%) occurred within West African EEZs (Figure 9). A proportion of these events will be related to normal sea operation of vessels including waiting to enter port, resupplying, and authorized transshipments. However, some may also be linked to unauthorized transshipments. Under the current reporting framework, investigating loitering events is challenging due to a lack of data on these activities.

The West African Coast has long been identified as a place of rich fishing grounds, and vulnerable to significant IUU fishing activity (Doubouya et al. 2017, INTERPOL 2014). In addition to the large amount of underreported fishing by foreign distant water fleets, and illegal fishing, incidents of piracy and human trafficking have also been prevalent in West African waters over the previous decades (Belhabib et al. 2019, INTERPOL 2014). Activities such as transshipment and disabling monitoring devices, such as AIS, enable IUU activity (INTERPOL 2014), and a need for MCS support in West African countries with less capacity for fisheries oversight has been recommended to identify potentially illicit activity (Belhabib et al. 2019, INTERPOL 2014).

A centralized VMS measure within ICCAT for all authorized vessels, including carriers, would ensure that all vessels are transmitting their location to the relevant authorities, and all reported activity can be validated. Additionally, ICCAT should consider including within their existing transshipment Recommendation the requirement of CPCs and the ROP to record and report any encounters unrelated to the transfer of fish occurring within the ICCAT Convention Area. This would increase the transparency around carrier vessel activity at sea and would improve ICCAT’s already robust reporting requirements.

Case Study: Activity in West African EEZs

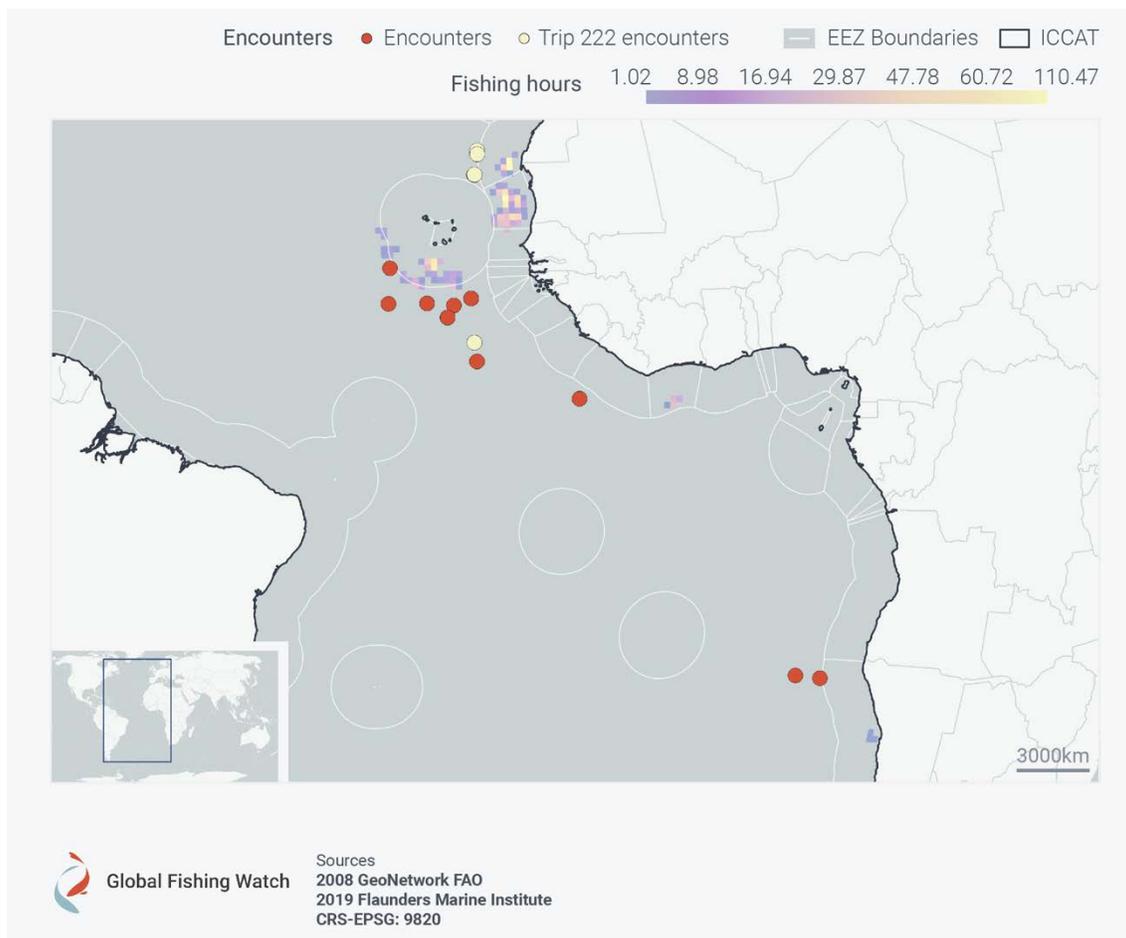


Figure 10. Encounters after fishing by longline vessels inside West African EEZs

In the image above, the red circles represent encounters between carriers and longline vessels which occurred after the longliners were observed fishing within nearby EEZs. All of these encounters occurred during ROP reported carrier trips. The fishing effort is shown in a gradient of purple to yellow, yellow indicating more fishing hours. Both the fishing and carriers observed in these encounters are flagged to ICCAT CPCs. However, in this image, it is clear that longline vessels spent time fishing within West African EEZs, and then encountered carriers after, on the

high seas. It is therefore possible that species caught within coastal State's EEZs were transferred and landed outside of the EEZ. Therefore, member States may wish to consider increased oversight of transshipment activity conducted just outside their national areas/waters through improvements to the current transshipment Recommendation to ensure that transfers of fish caught within EEZs are being properly monitored and reported to relevant authorities in near real time.

The encounters directly outside of the Mauritania EEZ occurred during reported trip 222 (see Doc. No. PWG_402/2019), however, no observer report was identified and therefore no reported transshipments could be matched to this AIS data.

Port Visits

A number of ports were visited after encounters and loitering events occurred in the Convention Area in 2018, chief among them was Porto Grande, Cape Verde (Figure 10).

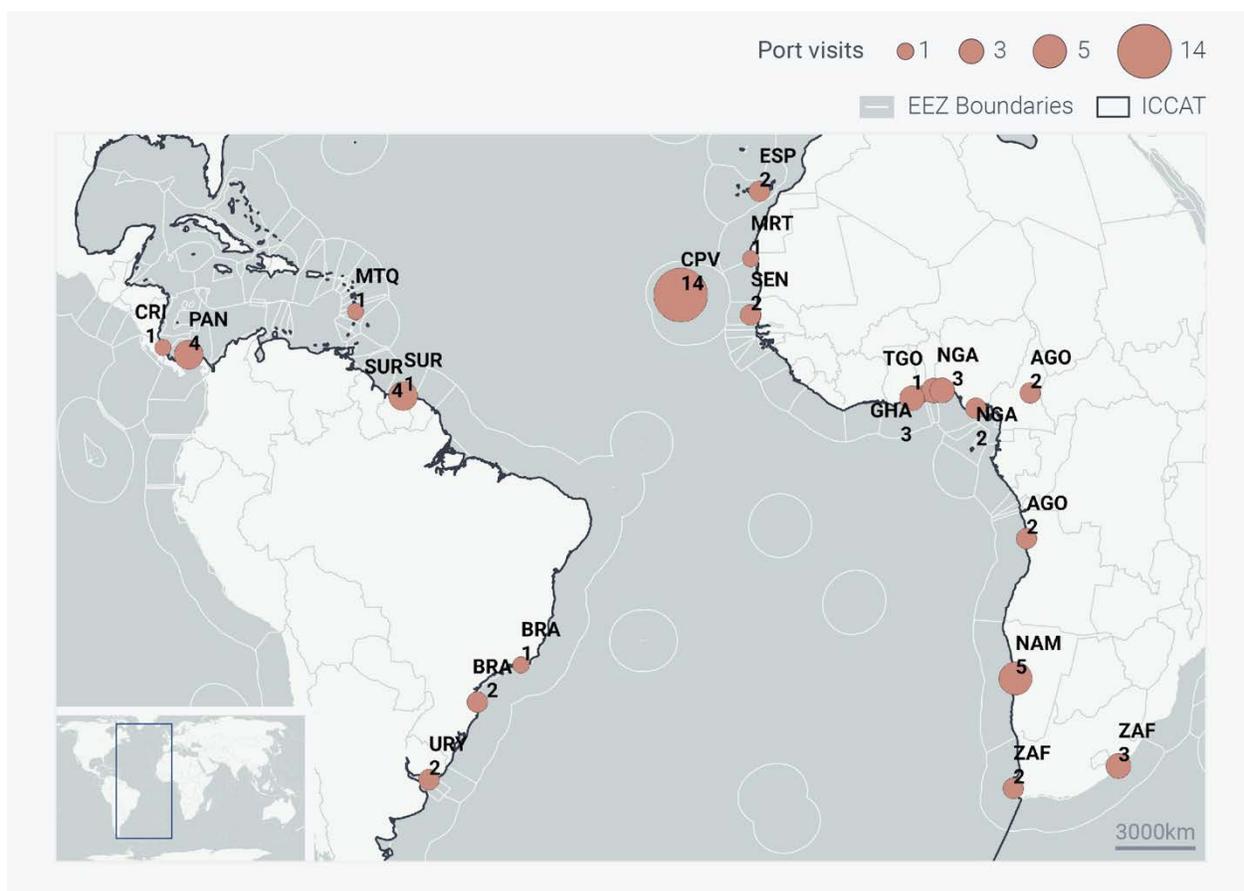


Figure 10. Count of port visits by carriers after potential transshipment events on the high seas in the ICCAT Convention Area.

Designated ports of entry

ICCAT General Recommendation [18-09](#) on Port State Measures requires CPCs which open their ports to foreign flagged vessels carrying ICCAT-managed species, and/or fish products originating from such species, that have not been previously landed, to designate ports of entry and share their list of designated ports with the ICCAT Secretariat, who shall keep record of those ports on the ICCAT website. Two of the eight ports visited by carriers after an encounter with a longline vessel are not within CPC States, and are therefore not designated ports of entry under the ICCAT [Record of Ports](#) (Table 1). This raises the risk that ICCAT-managed species are entering ports of non-CPCs, and are potentially not being subject to the level of controls required by ICCAT of its CPCs. This is a potential loophole that can be exploited by IUU operators and highlights the need for consistent PSMs, in line with the PSMA, across all RFMOs.

Table 1. Port Visits by Carriers after Encounter Events with Longline Vessels

Port State	Port	PSMA ³	PSMA DPE ⁴	ICCAT DPE ⁵	ICCAT CPC ⁶	Carrier Visits
Cabo Verde	Porto Grande	Yes	No	Yes	Yes	13
Mauritius	Port Louis	Yes	No	No	No	4
Singapore	Singapore	No	No	No	No	4
Namibia	Walvis Bay	Yes	Yes	Yes	Yes	3
Senegal	Dakar	Yes	No	Yes	Yes	2
South Africa	Cape Town	Yes	Yes	Yes	Yes	2
Panama	Colon	Yes	No	Yes	Yes	1
South Africa	Durban	Yes	Yes	Yes	Yes	1

³ <http://www.fao.org/treaties/results/details/en/c/TRE-000003/>

⁴ <http://www.fao.org/fishery/port-state-measures/psmaapp/?locale=en&action=qry>

⁵ <https://www.iccat.int/en/Ports.asp>

⁶ <https://www.iccat.int/en/contracting.html#>

Ports designated for entry under ICCAT General Recommendation 18-09 are ports within which port State CPCs must guarantee a certain standard of port inspections. Any ports used to land or transship ICCAT managed species which are not designated for entry by ICCAT CPCs may not provide the same level of inspection and oversight of landed catch. As noted in Paragraph 43 of ICCAT 18-09, *“The Commission shall review this Recommendation no later than its 2020 Annual Meeting and consider revisions to improve its effectiveness”*. Therefore, at this year’s ICCAT meeting, the Commission may want to revise 18-09 to ensure more effective oversight in ports not currently designated for entry under the Record of Ports. Furthermore, the below table details the ports which were visited by carriers after AIS detected loitering events. Of the top 10 ports visited, only seven are designated ports of entry under ICCAT’s Record of Ports (Table 2).

Table 2: Top 10 Ports visited after loitering events

Port	Country	PSMA	PSMA DPE	ICCAT DPE	ICCAT CPC	Carrier Trips
Porto Grande	CPV	Yes	No	Yes	Yes	13
Walvis Bay	NAM	Yes	Yes	Yes	Yes	5
Colon	PAN	Yes	No	Yes	Yes	4
Port Louis	MUS	Yes	No	No	No	4
Singapore	SGP	No	No	No	No	4
Paramaribo	SUR	No	No	Yes	Yes	4
Durban	ZAF	Yes	Yes	Yes	Yes	3
Cotonou	BEN	No	No	No	No	3
Lagos	NGA	No	No	No	Yes	3
Tema	GHA	Yes	Yes	Yes	Yes	3

The above tables not only highlight the ICCAT designated ports of entry but also the status of ports visited under the FAO's PSMA. Seven of the eight port States visited by carriers after an encounter are party to the PSMA, however, four of these seven ports are not designated for entry under the PSMA, even though three of those four ports are designated for entry through ICCAT. Additionally, when considering ports visited after loitering events, the percentage of PSMA ratified ports decreases substantially.

Port State CPCs should consider designating their ports for entry for tuna and tuna-like species under both ICCAT regulations and through the PSMA to ensure effective monitoring and control of landing of ICCAT managed species, and to prevent IUU sourced catch from entering the supply chain. Since ICCAT General Recommendation 18-09 is aligned with the PSMA, ICCAT should consider requiring those ports to be designated under the PSMA and ensure the same level of control over vessels carrying ICCAT-managed species as well as any other product.

Visits to Porto Grande

Porto Grande, Cape Verde was the most visited port by carriers after encounters and loitering events in the ICCAT Convention Area in 2018. In fact, every carrier trip documented in the 2018 ROP report includes a stop in Porto Grande, though these port visits are not documented in the detailed MRAG reports. The high number of port visits suggest the port is used as a stopover by carriers during longer voyages, as was the case during the previous year's ROP. GFW's [2017 ICCAT transshipment report](#) identified 13 port visits to Porto Grande during a longer carrier deployment, noting that it was unclear if these visits involved the offloading of fish, or if stops were made solely for other reasons. It is important to note that if carriers have non-landed ICCAT managed fish on board when visiting a port, then their activity is covered by the PSMs, which includes visits to "...port for landing, transshipping, packaging, or processing fish that have not been previously landed and for other port services, including, inter alia, refueling and resupplying, maintenance and dry docking" (Gen Rec 18-09 pg 4-5).

Given the frequency of visits to the port, ICCAT and member States may consider increasing port inspection controls and measures in Porto Grande to ensure compliance to transshipment and landing CMMs. Considering the importance of traceability of the catches, ICCAT should adopt stringent reporting requirements for in-port transshipments, such as in-port observer reporting when present, and should ensure that such reports are made available to port State authorities to facilitate the implementation of Gen Rec 18-09.

Conclusions and Recommendations

This analysis highlights the complicated nature of managing at-sea transshipment in the ICCAT Convention Area. Though current oversight and reporting mechanisms are more advanced than

other tuna RFMOs, there are still improvements to be made to ensure increased transparency and consistency in managing transshipments of ICCAT managed species.

With carrier vessel trips detected via AIS which occurred outside the scope of the ROP, there is a clear risk for transshipments to go unobserved and unreported. Additionally, Member States may want to increase oversight over their own managed waters, as AIS data showed transshipments were taking place just outside an EEZ after observing significant fishing effort within it.

Finally, ports visited after encounters with longline vessels and loitering events highlights the need to ensure effective port inspection schemes during landing. ICCAT may want to encourage port States to designate official ports of entry to improve transparency of port landings. These key findings and corresponding recommendations for the Commission to consider are provided in the table below:

Finding	Recommendation
<ul style="list-style-type: none"> While ICCAT has one of the most transparent ROPs of all tuna RFMOs, recorded information is variable in quality 	<ul style="list-style-type: none"> Standardize the information required from ROP, and ensure consistency in reporting.
<ul style="list-style-type: none"> Carrier vessel trips/encounters were conducted outside of the scope of the ROP. 	<ul style="list-style-type: none"> Investigate potential transshipment activity which was not reported on by the ROP. Additionally, ensure the ICCAT registry includes up to date information regarding flag States of active carriers conducting transshipments within the Convention Area.
<ul style="list-style-type: none"> There were a high number of loitering events vs encounters. 	<ul style="list-style-type: none"> For more effective MCS, implement a centralized VMS system to ensure effective oversight of carrier and fishing vessel activities. Expand the current ICCAT Recommendation on Transshipment requirement of CPCs and the ROP to record and report any non-transshipment encounters occurring within the ICCAT Convention Area.

<ul style="list-style-type: none"> • Encounters were detected just beyond EEZ limits following significant observed fishing effort within them. 	<ul style="list-style-type: none"> • Ensure that fish transferred outside of EEZs are effectively monitored and reported to relevant authorities by establishing MoUs with non-CPC port States.
<ul style="list-style-type: none"> • There were a high number of port visits to Porto Grande, Cape Verde, and the purpose of these visits is unknown. 	<ul style="list-style-type: none"> • Require ROP observers to report on non-transshipment port activity, like transfers and offloading of crew and equipment, and refueling, during ROP observed voyages.
<ul style="list-style-type: none"> • Carriers visited non-CPC ports after encounters with longline vessels. 	<ul style="list-style-type: none"> • Ensure compliance with General Recommendation 18-09 on Port State Measures requiring use of ICCAT designated ports by carriers when offloading transshipped catch. • Encourage port authorities in non-CPC port States to share landing declarations at ports used by carriers when landing ICCAT caught species.

The spatial alignment between the MRAG ROP and this comprehensive analysis of AIS-based CVP data demonstrates an additional method for correlation of information to help build a more comprehensive assessment of vessel activity on the high seas for all flag States and vessel types. This should help enable improved regulation and management of transshipment activity. Member States should consider implementing comprehensive national AIS requirements for their authorized fleets to assist this. Critically, the Commission should consider tasking the ICCAT Secretariat to conduct annual reviews of transshipment activity using all sources of information available to build on this initial analysis by GFW and validate the efficacy of the ICCAT transshipment management measures.

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Annex 1. Detailed Methodology

AIS-based data methods

Carriers registered over 300 gross tons and on international voyages are already required to broadcast on Automatic Identification System (AIS), as mandated by the International Maritime Organization (IMO) (IMO 2002). Although the use of AIS is not globally mandated for fishing vessels, AIS used in fishing fleets is increasing with a growing number of flag and coastal States mandating its use through their own national or regional fisheries regulations. AIS devices broadcast the location of a vessel along with other information, including identity, course and speed. This makes the use of AIS, and its subsequent analysis, very useful in understanding fishing activity that can be used to support and complement existing national and RFMO Monitoring, Control and Surveillance (MCS) programs. This is especially true as AIS can provide a greater insight of fishing vessel activities, especially when these interactions involve vessels of differing flag States where VMS data is not publicly available or readily shared between authorities.

The Carrier Vessel Portal (CVP) is established using GFW datasets developed from AIS data. The CVP uses the same datasets used in the 2017 transshipment reports (<https://globalfishingwatch.org/rfmo-transshipment/>), including possible transshipment events defined as encounter and loitering events, port visits by carriers, vessel identity information broadcast from AIS, and publicly available vessel registry data.

GFW uses publicly broadcasted AIS data to estimate vessel information and vessel activity, including fishing, encounters and loitering events. Encounters, where two vessels meet at sea, may indicate possible transshipment activity between two vessels. Vessel encounters are defined when two vessels are within 500 meters of each other for at least 2 hours and traveling at < 2 knots, while at least 10 kilometers from a coastal anchorage (Miller et al. 2018). Whereas, vessel loitering is when a carrier vessel travelled at speeds of < 2 knots for at least 4 hours, while at least 20 nautical miles from shore (see Miller et al. 2018 for original methodology, however the original minimum of 8 hours has been changed to 4 hours for the purposes of this study).

Loitering by a single carrier vessel where the carrier vessel exhibits behavior consistent with encountering another vessel at sea, but no second vessel is visible on AIS, may also indicate a possible transshipment event but where there is no AIS data for the second vessel, also known as a 'dark vessel' (Figure A1). Loitering events may indicate a possible

encounter for which data is lacking for the second vessel, possibly due to lack of AIS transmission, poor satellite coverage, or the size of the second vessel (INTERPOL 2014).

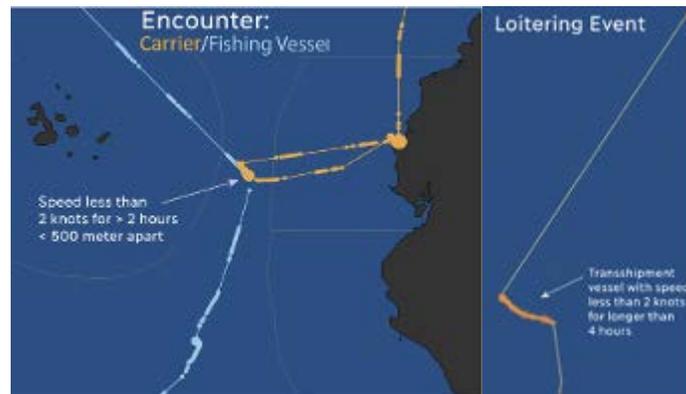


Figure A1 - Examples of vessel tracks during typical 'Encounter' where two vessels meet at sea and 'Loitering' events where a carrier vessel (referred to as transshipment vessel) has behavior consistent with encountering an LSTLV at sea but no LSTLV is visible on AIS

The GFW database also contains an estimate of port visits conducted by carriers (see Annex 2). GFW defines ports as any 0.5-kilometer grid cell with 20 or more unique vessels stationary for greater than 12 hours. A port visit includes the port entry and exit of a vessel if the vessel stops. A vessel "enters" port when it is within 3 kilometers of a GFW-defined port. A vessel has 'stopped' when it has entered port and slowed to a speed of 0.2 knots and has started movement again when it moves over 0.5 knots. A vessel "exits" port when it is at least 4 kilometers away from the previously entered port. Note, for the purposes of this analysis any port visits that had a duration of less than 3 hours were removed from the data. Port stops can vary in duration from less than an hour to multiple weeks. Generally, very short port stops, as defined by GFW, may be intermediate ports a vessel stops at before entering a port to conduct activities of interest to this report, such as offloading of catch. Therefore, in an attempt to exclude intermediate ports, this analysis excluded port visits of less than 3 hours, so that all voyages ended at ports where the carriers remained for at least 3 hours.

The carrier and fishing vessels analyzed in this report were chosen based on the GFW database of fishing and carriers. The fishing database is defined in Kroodsma et al. (2018) and includes fishing vessels based on registry database information or as defined by a convolutional neural network (Kroodsma et al. 2018). Fishing vessels capable of fishing tuna were defined by the GFW vessel classification using known registry information in combination with a convolutional neural network used to estimate vessel class (network described in Kroodsma et al. 2018). The carrier database is defined in Miller et al. (2018) and was curated using International Telecommunication Union and major RFMOs, vessel movement patterns based on AIS, a convolutional neural network

used to estimate vessel class (see Kroodsma et al. 2018) and the International Maritime Organization (IMO) unique identifier.

For the purposes of the ICCAT 2018 transshipment analysis loitering events were restricted to those that are ≤ 24 hours in duration, due to a finding from the 2017 transshipment reports (for example see section 4.6 in the 2017 ICCAT report found here: <https://globalfishingwatch.org/rfmo-transshipment/>) that these loitering events are more likely to indicate possible transshipment activity.

For the case study focusing on apparent fishing hours inside EEZs prior to encounter events the fishing hours were calculated if they occurred after leaving port and after any previous carrier encounter and within three weeks prior to an encounter with a carrier vessel. Apparent fishing hours were summed by 0.5 degree bins. Apparent fishing is estimated using a convolutional neural network that uses AIS based data such as vessel speed, direction, and rate of turn to classify if a fishing vessel is likely fishing or transiting (not fishing) (See Kroodsma et al. 2018).

Vessel authorization was established by using the publicly available vessel registry produced by ICCAT⁷ and CCSBT⁸ along with the ICCAT Observer Reports⁹. If a carrier or fishing vessel was listed as 'authorized' on any of the public registries during an encounter or loitering event the event was considered 'authorized'. However, if a vessel was not authorized on one of the three registries during the time period of an encounter or loitering event the authorization status is unknown. The ability to determine vessel authorization is largely dependent on the accuracy and comprehensiveness of the public registries, as well as the vessel information (name, MMSI, IMO, callsign) transmitted on AIS by the vessel and used by GFW.

Data caveats

The analysis presented in this report relies on commercially available AIS data and publicly available information. Therefore, the AIS data is limited by those vessels that transmit AIS data and do so by providing accurate vessel identity information. AIS data can be tampered with, but GFW does implement methods to help correct for false AIS data. Low satellite coverage of high-density areas can also limit AIS data usefulness, although the high seas ICCAT Convention Area has relatively strong Class-A AIS coverage, with the exception of the Gulf of Mexico, parts of Europe outside the range of

⁷ <https://www.iccat.int/en/VesselsRecord.asp>

⁸ <https://www.ccsbt.org/en/content/ccsbt-record-authorized-vessels>

⁹ <https://www.iccat.int/en/ROP.html>

terrestrial receivers along the coast, and parts of the southern Atlantic Ocean (see Taconet, Kroodsma, and Fernandes 2019). AIS data tends to be sparser and more limited for vessels equipped with Class-B AIS devices (Kroodsma et al. 2018). For further analysis of GFW AIS data quality in the Atlantic Ocean refer to: Taconet, Kroodsma, and Fernandes 2019. AIS device class often depends on flag State regulations, vessel length, and vessel purpose. Because of the limitations of AIS data, lack of complete and accurate public vessel databases and registries, and limitations of modelling estimations, the AIS detected encounter, and loitering data are represented as accurately as possible but should be considered restrained estimates based on these limitations (see Kroodsma et al. 2018, Miller et al. 2018, and <https://globalfishingwatch.org/> for further discussion).