



**Global Fishing Watch**

**A 2018 Comparative Analysis of Reported Carrier Trips and  
Transshipments in the Inter-American Tropical Tuna Commission  
(IATTC) Convention Area using AIS Data**

## Acknowledgments

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 Tuna Regional Fishery Management Organizations

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, 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 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 management bodies, including registry data to identify and display information on carrier vessel movements and potential transshipment activity.

Utilizing the information behind the CVP, GFW and Pew are releasing a series of annual reports that compare at-sea transshipment-related activities and port visits observable through AIS data with publicly available information generated from RFMO member implementation of the relevant RFMO at-sea transshipment management measures. 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, and vessel speeds. ‘Loitering Events’ are identified when a single carrier vessel exhibits behavior 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](mailto:carrier-vessel-portal-support@globalfishingwatch.org).

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## List of Acronyms

AIS – Automatic Identification System

CPC - Members and co-operating non-Members of the Commission

CVP - Carrier Vessel Portal

GFW - Global Fishing Watch

IATTC – Inter-American Tropical Tuna Commission

ICCAT - International Commission for the Conservation of Atlantic Tunas

IMO - International Maritime Organization

LSTLV – Large-Scale Tuna Longline Vessel

MCS – Monitoring, Control and Surveillance

MMSI – Maritime Mobile Service Identity

MoU - Memorandum of Understanding

PSMA – Port State Measures Agreement

RFMO – Regional Fisheries Management Organization

SPRFMO – South Pacific Regional Fisheries Management Organization

WCPFC – Western and Central Pacific Fisheries Commission

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

The capture, transfer, and landing of tuna and tuna-like species in the eastern Pacific Ocean is managed by the Inter-American Tropical Tuna Commission (IATTC). Transshipment activity in the IATTC Convention Area is currently managed by [Resolution C-12-07 on establishing a program for transshipments by large-scale fishing vessels](#). Per this resolution, at-sea transshipments of IATTC managed species can only be conducted by large-scale tuna longline fishing vessels (LSTLVs) and carrier vessels.

In order to compare AIS data to reported transshipment data, GFW reviewed the annual transshipment report from MRAG Americas ([CAF-07 Addendum 1](#)) and the IATTC Secretariat report on the implementation of the Regional Observer Program (ROP) for 2018 ([CAF-07-03](#)). There were differences in the information reported in each report, and inconsistencies in what information was included in each report, making it difficult to validate reported information. Document CAF-07 Addendum 1 included 41 trips that were a subset of the 51 reported trips in CAF-07-03, with the addition of a trip not reported in CAF-07-03 due to a date discrepancy. Of the 52 IATTC reported trips by carrier vessels, GFW matched 42 to AIS detected carrier vessel trips that included encounters and/or loitering events in 2018. Although not all IATTC reported trips were matched to GFW data in this report, all reported trips can be identified by using the [Carrier Vessel Portal](#). This report is restricted to analyzing only data associated with encounter and loitering activity in the calendar year of 2018 consequently limiting the ability to match AIS data to reported trip data that may have occurred across years, and is shown in the Carrier Vessel Portal.

In addition to the trips matched to AIS, GFW detected seven other unreported and likely unobserved carrier vessel trips that occurred in the Convention Area and involved encounters with LSTLVs and/or loitering events. This activity was identified in the eastern portion of the IATTC Convention Area, where tuna are commonly found (see Figure A4 in the 2018 [IATTC fishery status report](#)). Just under a half of all AIS detected encounters and almost a third of all loitering events detected in IATTC that may have involved the transfer of fish that included tuna or tuna like species occurred within the IATTC-WCPFC Overlap Area. As was much of the LSTLV fishing activity prior to encounters in IATTC. This suggests that much of the catch involved in transshipments is likely sourced from this co-managed region.

Almost 50 percent of all ports visited by carriers after encounters within IATTC are located in non-IATTC member States. Furthermore, over 50 percent of these ports are within countries which are not party to the UN FAO Port State Measures Agreement (PSMA).

The analysis of 2018 carrier vessel activity indicates that the IATTC transshipment Resolution could be improved in the following ways:

Finding	Recommendation
<ul style="list-style-type: none"> <li>There were discrepancies in transshipment information provided by MRAG and the IATTC ROP, complicating efforts to analyze or validate reported transshipments.</li> </ul>	<ul style="list-style-type: none"> <li>Adopt consistent standards for reporting across all observer reports.</li> <li>Publish a consolidated trip report focused on a single calendar year inclusive of up-to-date flag State, registry, and transshipment location information during observer trips, OR</li> <li>Make the individual observer reports and annual transshipment reports from CPCs publicly available to allow for analysis and validation by third parties, and improve overall transparency of transshipment activity in the Convention Area.</li> </ul>
<ul style="list-style-type: none"> <li>Unreported carrier activity was detected in the eastern IATTC Convention Area</li> </ul>	<ul style="list-style-type: none"> <li>Investigate further and consider using AIS data to support the centralized VMS program to identify unreported activity.</li> </ul>
<ul style="list-style-type: none"> <li>A significant amount of the detected carrier activity occurred in IATTC-WCPFC Overlap Area</li> </ul>	<ul style="list-style-type: none"> <li>Strengthen the MOU with WCPFC to improve information sharing regarding transshipment activity</li> <li>Ensure training and certification, including cross certification of carrier observers is present in both RFMOs.</li> </ul>
<ul style="list-style-type: none"> <li>Half of all ports visited by carriers after encounters are within non-member States</li> <li>Half of all ports visited by carriers after encounters are in countries which are not party to the PSMA</li> </ul>	<ul style="list-style-type: none"> <li>Adopt a measure on minimum port inspection standards, in line with the minimum standards for port inspections included within the FAO PSMA.</li> <li>Ensure effective information sharing with non-member States to ensure port landing information is shared with the Secretariat.</li> </ul>

## Activity Overview

In 2018, Global Fishing Watch detected 1,108 encounters in the IATTC Convention Area between carrier vessels and fishing vessels via AIS analysis. Of these encounters, 397 occurred

between 25 carrier vessels and 219 LSTLVs, while the remaining 711 encounters were conducted with squid jiggers.

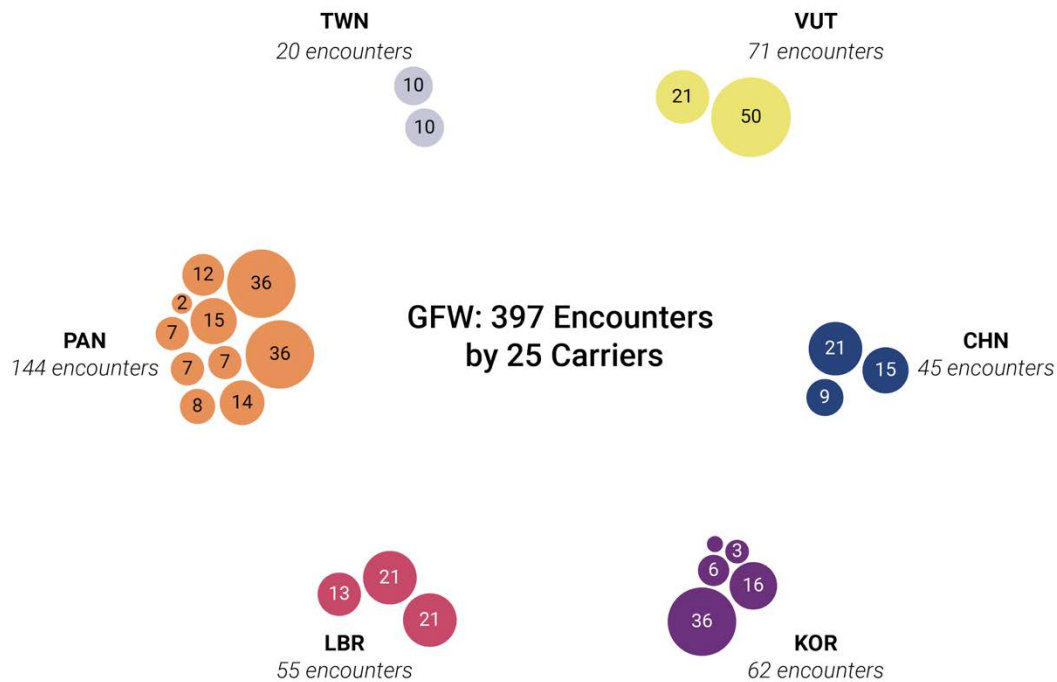


Figure 1. Encounter events by carrier flag State. *Note: Bubbles indicate unique carrier vessels*

In addition to the 1,108 encounters observed in the Convention Area, GFW also detected 1441 loitering events by 74 carrier vessels which were not matched to encounters<sup>1</sup>. Of these, 199 were conducted by 24 carriers that either also had encounters with LSTLVs or was on the IATTC registry and did not appear to have any encounters with squid jiggers in the Convention Area, suggesting this activity was most likely related to the transfer of tuna.

<sup>1</sup> Due to the definition of encounter and loitering events, loitering events can overlap with encounter events. Therefore, to determine the total number of possible transshipment events, the two event type totals were not simply summed. Any loitering event that overlapped in time with an encounter event by the same vessel, or was within 4 hours of an encounter event, was removed from the total count (see Annex 1).



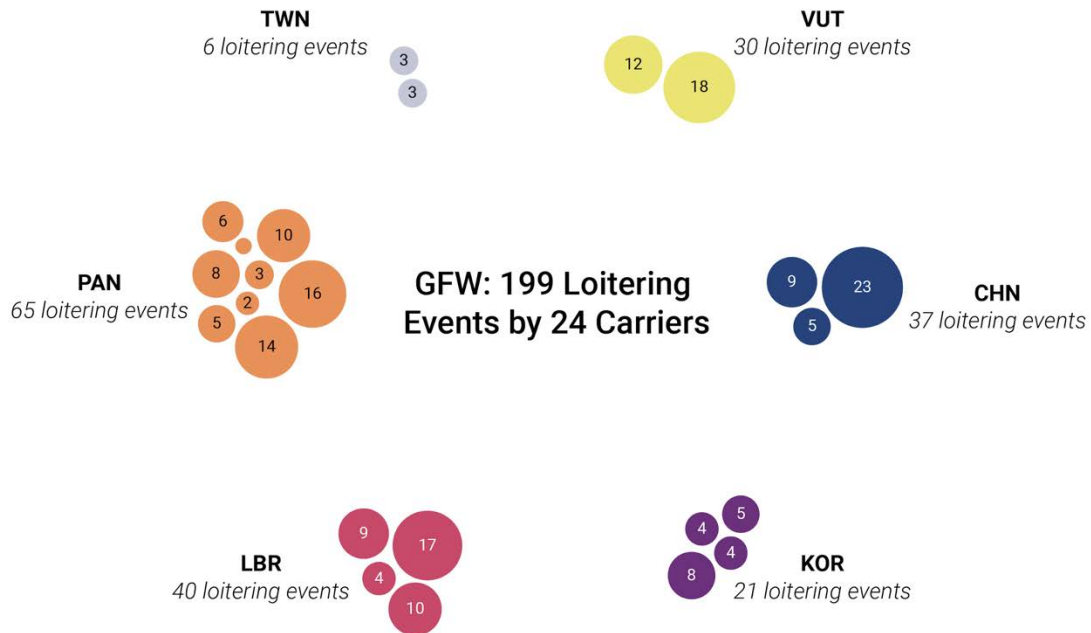


Figure 2. Loitering events by carrier flag State. Note: Bubbles indicate unique carrier vessels

1166 of the loitering events were conducted by carrier vessels that had also been detected in encounters with squid jiggers, and were therefore more likely related to squid. The remaining 76 loitering events were conducted by 24 carriers which were not identified as having encounters with either squid jiggers or LSTLVs, and were not found on the IATTC public registry.

### Observer Reported trips vs AIS data

According to the 2018 [Annual Report](#) from Marine Resources Assessment Group Americas (MRAG Americas) and [Document CAF-07-03](#) *On the implementation of the IATTC Regional Observer Program for Transshipments At Sea*, there were 52 carrier vessel trips with an observer on board during which transshipments of IATTC managed species occurred in 2018. It is important to note that CAF-07-03 contains 51 deployments in 2018 whereas the MRAG report captured a subset of these, displaying 41 observer deployments from January 2018 through February 2019, including an additional trip that did not appear in the CAF-07-03 table. This trip was recorded as occurring entirely in 2019, likely recorded in error and occurring in 2018 as identified in the CVP, and was included in the count of 52 total reported trips. In addition, in at least one instance the IMO record of flag State during 2018 varied from the flag information provided in these IATTC documents. A consolidated trip report focused on a single calendar year, with up-to-date flag State, registry information, and locations of transshipments during observer trips, would help yield more in depth and accurate analysis of carrier vessel activity.

Of the 52 trips reported by IATTC that occurred in 2018, GFW successfully matched<sup>2</sup> 42 to AIS data based on the encounter and loitering definitions used for this report (Table 1). In addition there were two AIS-detected carrier trips with encounters and loitering events in 2018 that matched to ROP trips documented in CAF-06-03 detailing trips that began in 2017 and not included in the 52 reported trips in 2018.

Table 1. Matched IATTC ROP Trips and AIS Carrier Trips in 2018

Flag	Number of Trips	Detected Carriers	Encounters	Loitering Events
CHN	3	2	36	23
KIR	6	2	67	12
KOR	7	5	31	15
LBR	3	2	33	17
PAN	14	9	92	55
TWN	2	2	20	6
VUT	7	4	80	31

The ten reported trips which were not matched to AIS data can all be seen in the Carrier Vessel Portal. They were not matched in this report because data is restricted to carrier trips that included encounter and loitering events in the calendar year of 2018 in the IATTC Convention Area as defined in the Annex (Table 2). However, all ten reported trips appeared to have potential transshipment activity, for example see the Carrier Vessel Portal link [here](#).

<sup>2</sup> AIS detected carrier trips which included possible transshipment events - including encounter and loitering events - was matched with reported observer data using carrier vessel identity and a buffer of two weeks on either end of the trip. The two-week window was used to account for differences in observer disembarkation/embarkation dates and locations and those observed via AIS.

Table 2. Carrier Trips Reported by the IATTC ROP Not Matched to AIS Data

Flag	Number of Trips	Detected Carriers	Encounters	Loitering Events
CHN	1	1	NA	NA
KIR	1	1	NA	NA
KOR	2	1	NA	NA
LBR	1	1	NA	NA
PAN	3	3	NA	NA
TWN	2	2	NA	NA

GFW identified seven carrier vessel trips on the IATTC registry<sup>3</sup> which had encounter and/or loitering events within the Convention Area but were not included in the Commission or ROP reports (Table 3).

Table 3. Carrier Trips Identified on AIS Not Matched to ROP in 2018

Flag	Number of Trips	Detected Carriers	Encounters	Loitering Events
CHN	3	2	9	14
LBR	1	1	0	9
VUT	3	1	17	10

<sup>3</sup> 2018 IATTC carrier registry data was provided by the IATTC Data Collection and Database Program upon request to identify possible authorization of these vessels. To access this data contact [info@iattc.org](mailto:info@iattc.org).

### North IATTC Activity without Observer on Board

Per IATTC Resolution C-12-07, "...each CPC shall ensure that all its carrier vessels that transship at sea have on board an IATTC observer, in accordance with the IATTC Regional Observer Program in Annex 3. The IATTC observer shall monitor compliance with this Resolution, and notably that the transshipped quantities are consistent with the catch reported on the IATTC transshipment declaration". Six of these seven trips detected on AIS were conducted by three carrier vessels identified on the IATTC registry and included AIS-detected encounters. However, they did not appear to have an observer on board based upon a review of the publicly available ROP data. The remaining trip had loitering events within the Convention Area, but no encounters were detected.



Figure 3. AIS Detected transshipment events not matched to an IATTC ROP trip

As seen in Figure 3, the 59 AIS-detected likely transshipment events between carriers and LSTLVs occurred in areas where IATTC managed species are typically caught (see Figure A4 in the 2018 [IATTC fishery status report](#)). This indicates a clear risk of IATTC managed catch being transshipped without an observer on board, in direct violation of IATTC transshipment regulations. To further illustrate the likelihood that these encounters are related to transshipment of IATTC managed species, Figure 4 details the geospatial activity of fishing

effort conducted by the LSTLVs that met with the carrier vessels, prior to the encounters shown above.



Figure 4. AIS Detected fishing hours prior to encounters not matched to an IATTC ROP trip

For the purposes of this report, fishing effort is defined as the number of hours where the AIS data is considered indicative of fishing<sup>4</sup>, based on geartype and elements of vessel movements such as speed and direction change. To prevent transfers of tuna and tuna-like species going unreported, IATTC should ensure that every carrier that is involved in the transfer of tuna has an observer onboard and increase observer coverage on LSTLVs.

<sup>4</sup> Any and all references to "fishing" should be understood in the context of Global Fishing Watch's fishing detection algorithm, which is a best effort to determine "apparent fishing effort" based on data from the Automatic Identification System (AIS) collected via satellites and terrestrial receivers. As AIS data varies in completeness, accuracy and quality, it is possible that some fishing effort is not identified and conversely, that some fishing effort identified is not fishing. For these reasons, Global Fishing Watch qualifies all designations of vessel fishing effort, including synonyms of the term "fishing effort," such as "fishing" or "fishing activity," as "apparent," rather than certain. Any/all Global Fishing Watch information about "apparent fishing effort" should be considered an estimate and must be relied upon solely at your own risk. Global Fishing Watch is taking steps to make sure fishing effort designations are as accurate as possible.

# Overlaps

The vast majority of carrier vessel activity, AIS-detected and reported, occurred in overlap areas with other RFMOs. To ensure good governance and oversight of carrier vessel activities, IATTC should strengthen information sharing agreements with these RFMOs, and consider cross certifying observers onboard carrier vessels which operate in them.

## WCPFC Overlap

Of the 397 carrier encounters involving LSTLV observed on AIS, 154, or nearly 40 percent, took place in the IATTC-WCPFC overlap area. Similarly, 34 percent, or 67 of the 199 loitering events not matching an encounter event and thought to be related to LSTLV activity took place in the IATTC-WCPFC overlap area.

In general, the flag State activity dynamics are similar inside and outside of the overlap area, though Chinese-flagged carriers are less active in the overlap. Panama remains the most active carrier fleet inside and outside of the overlap area, followed outside the overlap by China, Vanuatu, and Liberia. Inside the overlap, Liberia, Vanuatu, and Korea have the highest count of possible transshipments after Panama (figure 5).

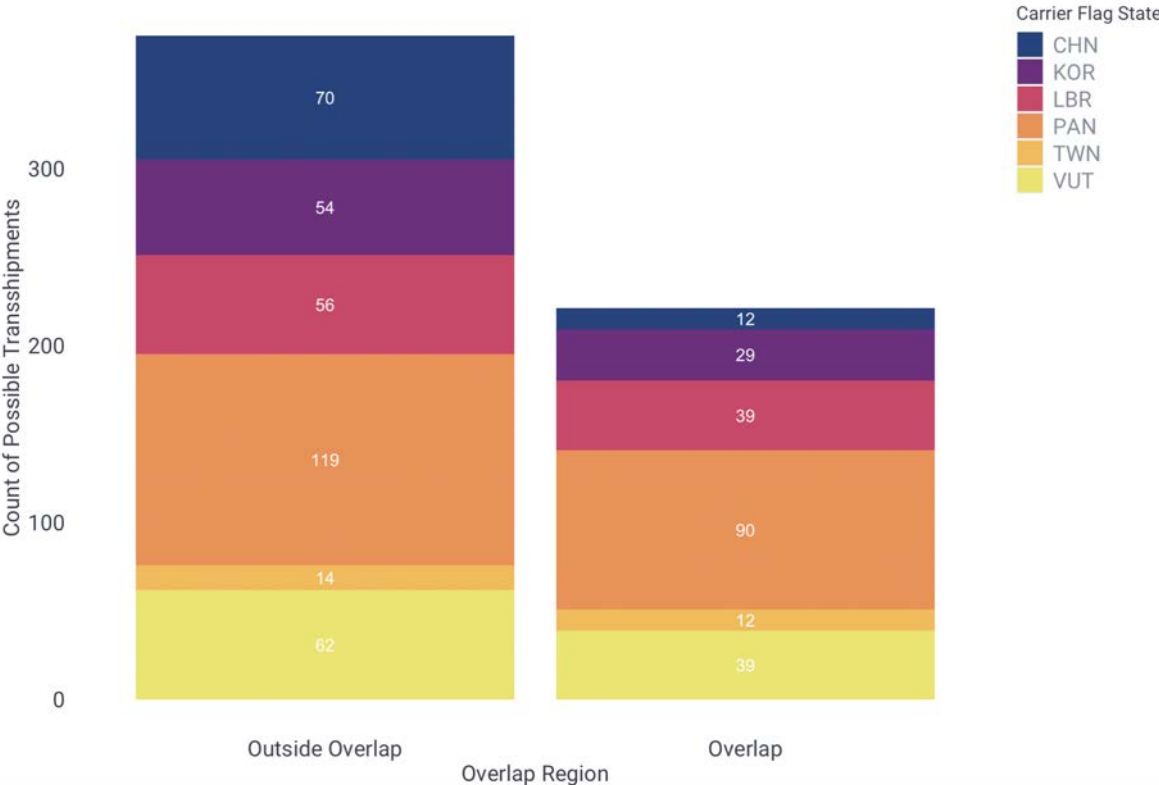


Figure 5. Count of possible transshipments by carrier flag State within and outside the IATTC-WCPFC overlap

AIS analysis indicates that when a possible transshipment event occurs within the IATTC-WCPFC overlap area, the majority of fishing hours conducted by the LSTLV prior to the encounter also occur in the overlap area. Likewise, if the encounter was observed within IATTC only managed waters, the fishing activity conducted by the LSTLV prior to the encounter also occurred within IATTC only managed waters. In figure 6, the fishing hours in red indicate the location and quantity of fishing hours prior to transshipments in the overlap area, whereas the blue indicates location and quantity of fishing hours prior to transshipments outside the overlap area in IATTC.

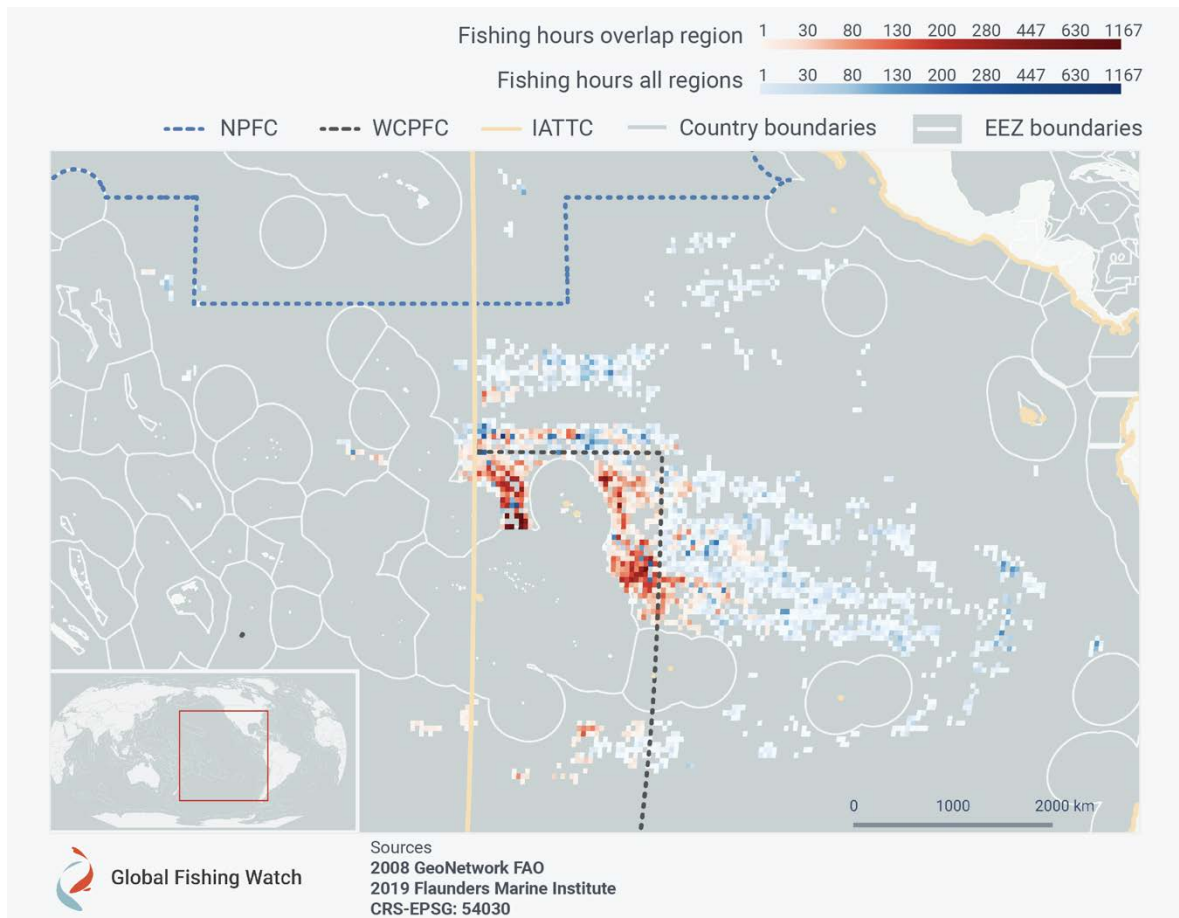


Figure 6. Fishing hours prior to encounters within the IATTC-WCPFC overlap (red) and encounters outside the overlap (blue).

Within a single trip, carriers may have transshipments that involve activity both within and outside the overlap area. In the example below (Figure 7) a carrier vessel has potential transshipments both outside and within the IATTC-WCPFC overlap area before entering port in French Polynesia.



Figure 7. Track a carrier vessel with potential transshipment activity around the IATTC-WCPFC overlap area

The amount of fishing activity, encounters and loitering events by carrier vessels in the overlap highlights the need for a strong relationship between IATTC and WCPFC with reported allocation of effort to the relevant RFMO nominated by the flag State. While an MoU already exists between the two organizations, IATTC and WCPFC should consider strengthening it to include transshipment specific information sharing that ensures effective oversight of their dually managed waters and species. Additionally, both RFMOs should ensure training and certification, including cross certification of carrier observers, as is currently allowed for longline observers, to improve observation of at-sea activities. For more information on the benefits of cross certification, see [The Pew Charitable Trusts Review of IATTC Transshipment Practices 2018](#).



## SPRFMO Overlap

There were 1090 AIS detected encounter events in the IATTC Convention Area in 2018. Of these encounters, 711 occurred between carrier vessels and squid jiggers, meaning 64 percent of all observed carrier vessel encounters occurring within the IATTC Convention Area were likely not related to the transfer of IATTC managed species. As were 81 percent of all AIS-detected loitering events not matched to encounters in the IATTC Convention Area.

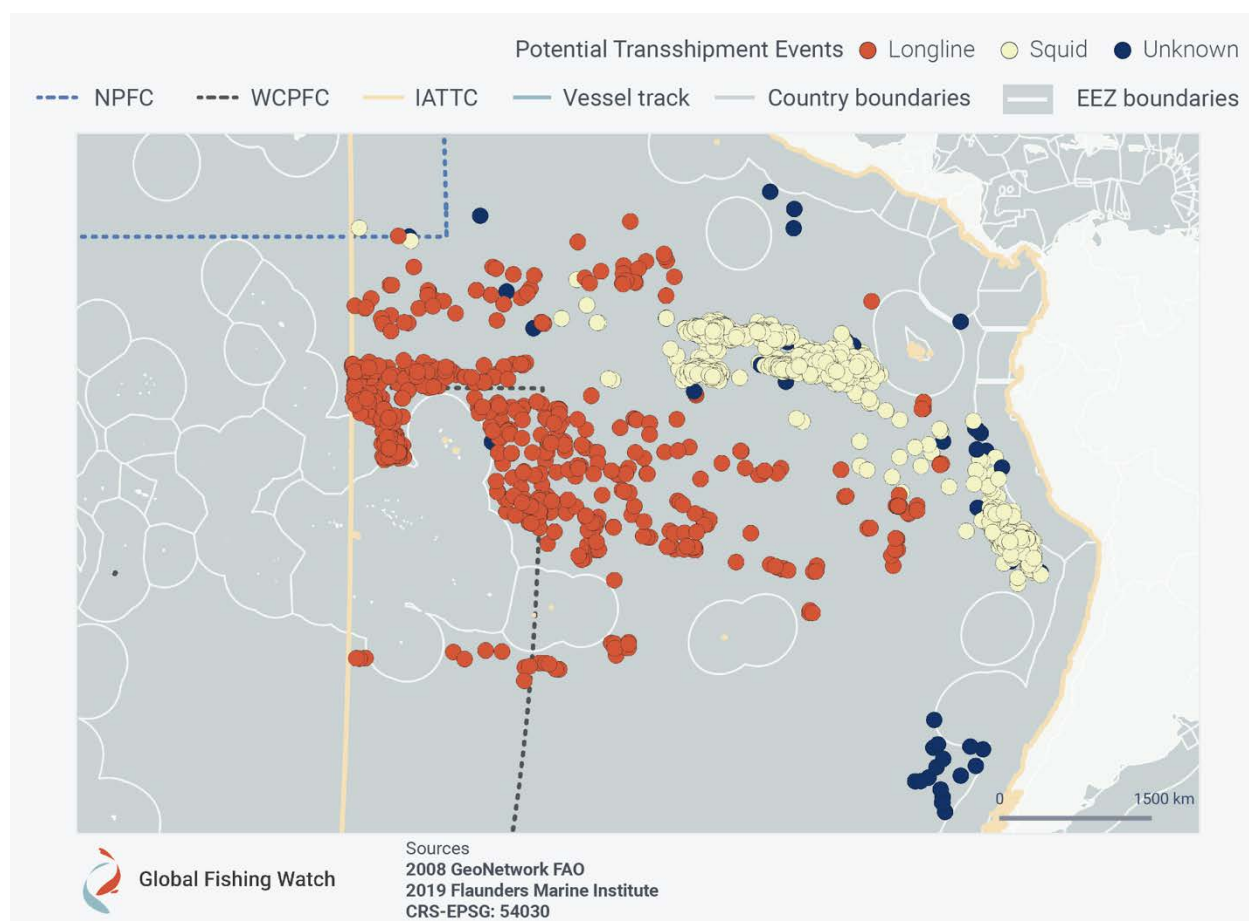


Figure 8. AIS detected transshipment events in IATTC by possible fishery

While none of the carriers that were detected in encounters with LSTLVs were detected in the encounters with squid jiggers, 11 carrier vessels observed in encounters in the IATTC Convention Area in 2018 held authorizations from both IATTC and the South Pacific Regional Fisheries Management Organization (SPRFMO), which manages the squid fishery in the South Pacific. SPRFMO and IATTC have an MoU, [COMM 8 - Prop 20](#), but this agreement has no mention or provisions regarding transshipments.

As SPRFMO and IATTC share so much of their areas of management, both RFMOs should seek to implement an MoU that ensures each party shares and cross checks information relevant to transshipments. The lack of formal information sharing mechanisms related to transshipment between the two organizations and minimal oversight over squid transshipments is an area of risk for IATTC. More information on this fishery and the transshipments occurring within IATTC's Convention Area, regardless of target species, will reduce this risk and strengthen governance efforts within IATTC's waters.

## Port Dynamics

Most RFMOs have adopted port State management measures where best practice is in alignment with the FAO Port State Measures Agreement (PSMA). IATTC, however, has yet to do so or to even implement a CMM focused on port State controls. The lack of a PSM puts IATTC managed species at risk given the number of carriers observed visiting non IATTC member port States, which were not PSMA signatories, after encounters with LSTLVs that had been observed fishing in IATTC managed waters. The AIS-detected port visits by carrier vessels after an encounter and/or loitering event in IATTC are shown in the figure 9.

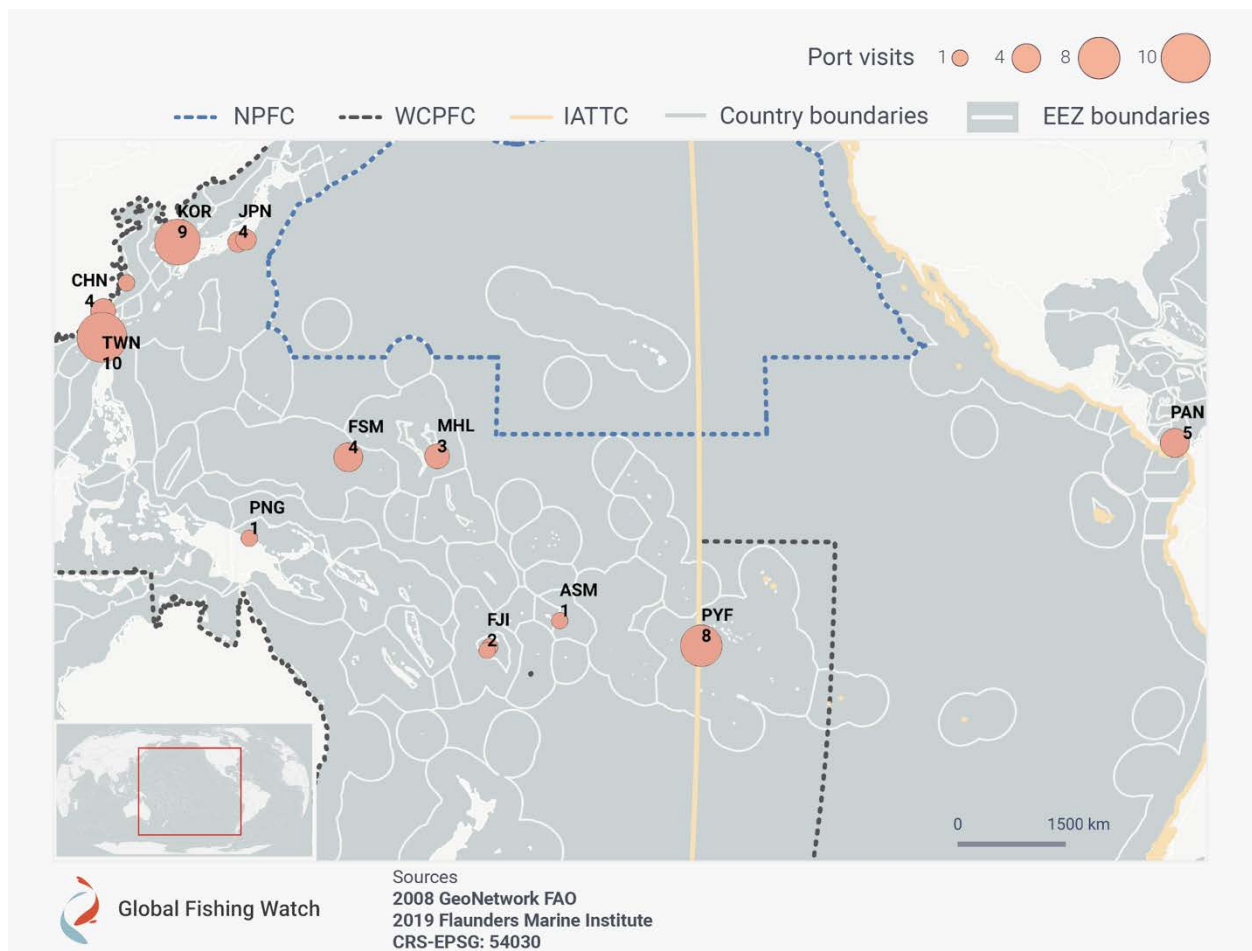


Figure 9. Count of port visits by carriers after potential transshipment events within IATTC, 2018

After trips that included encounters and/or loitering events in the IATTC Convention Area, carrier vessels visited 15 ports in 11 States. The most frequented ports States were Chinese Taipei, Korea, French Polynesia, and Panama (Figure 10). Of the 11 port States visited by carriers, five are not members of IATTC and only five of the port States visited are parties to the PSMA<sup>5</sup>.

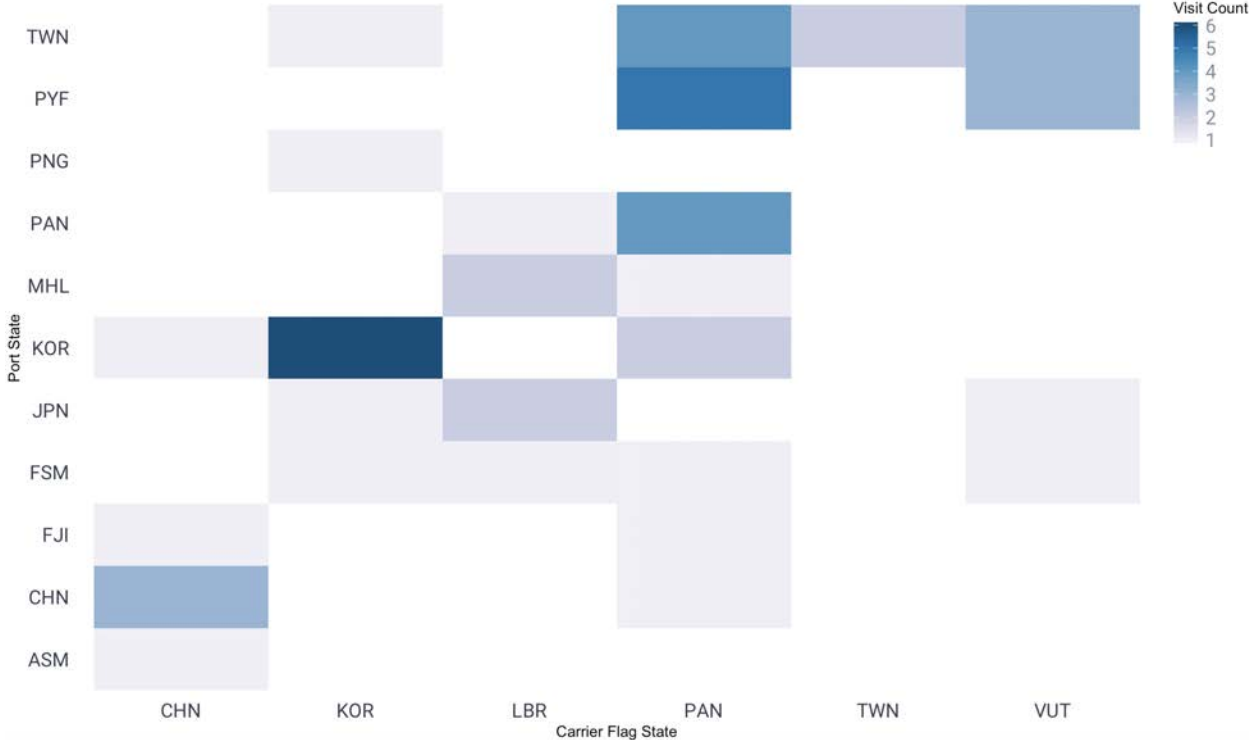


Figure 10. Count of port visits after potential transshipment events by carrier flag State

Nearly half of all ports visited by carrier vessels landing IATTC managed species are not member States of IATTC, and half of ports visited are not in States party to PSMA. Effective implementation of a comprehensive port State management measure, paired with information sharing, and cooperation amongst member States and other RFMOs can help combat IUU fishing and can increase transparency of transshipment activity at sea and in port.

Example: Carrier Visits to Papeete and Fuzhou

As shown in figure above, carriers flagged to Vanuatu and Panama were the most active fleets in the Convention Area in 2018. The ports these carriers visited after encounters are largely in States that are either not party to the FAO PSMA<sup>6</sup>, or are not designated as a port of entry for foreign-flagged vessels under that Agreement<sup>7</sup>, and are also not covered by strong Port State Measures under other RFMOs (WCPFC CMM 2009-06). Therefore, the chances of unreported catch or illegally caught IATTC-managed species entering such ports increases.

<sup>5</sup> Under the UN framework Taiwan, China is not eligible to ratify the PSMA

<sup>6</sup> <http://www.fao.org/treaties/results/details/en/c/TRE-000003/>

<sup>7</sup> <http://www.fao.org/fishery/port-state-measures/psmaapp/?locale=en&action=qry>

Additionally, GFW analyzed ports visited by carrier vessels after trips that included AIS-detected encounters or loitering events in the Convention Area, but which were not included in the ROP report. For these instances, Papeete and Fuzhou were the most visited ports (Figure 11).

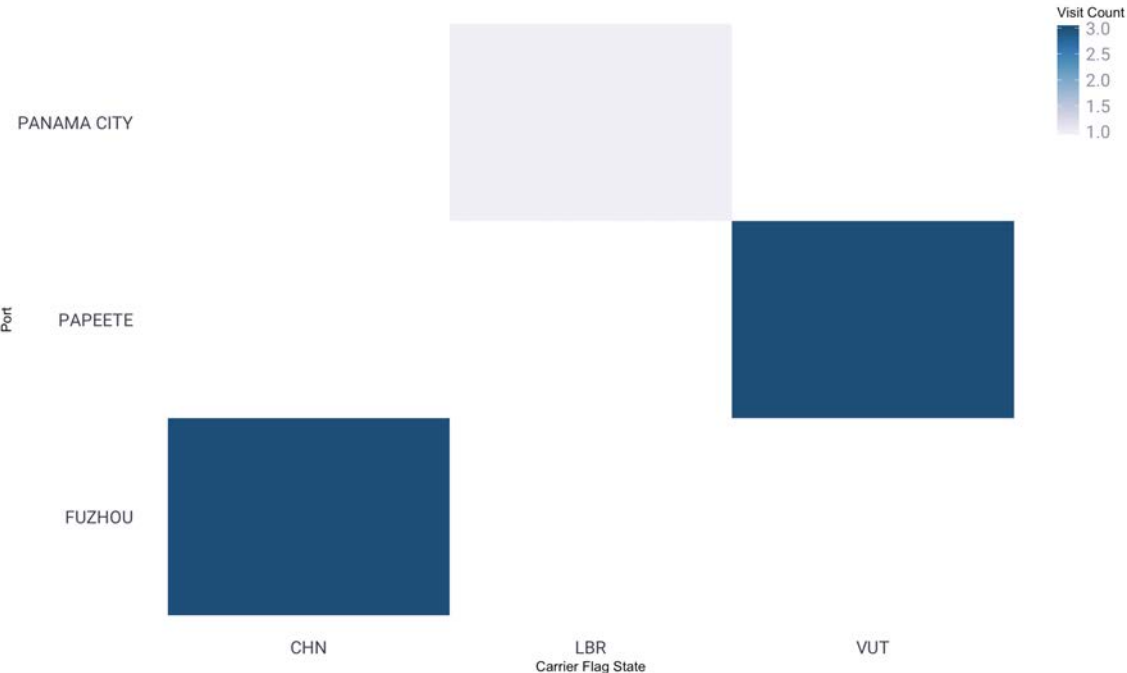


Figure 11. Count of port visits by carrier flag State after AIS detected potential transshipment events not reported by the IATTC ROP

For those trips, not only has the catch potentially gone unobserved via an official ROP Observer during the transshipment phase of its journey to market, but this catch has also been landed in ports which may lack effective controls in place to ensure no IUU catch is being landed (See the [PSMA designated ports](#)). Therefore, IATTC should implement stronger, comprehensive port controls to ensure good governance and effective oversight, as these are areas of increased risk.

### Conclusion and Recommendations

This analysis highlights the complicated nature of managing at-sea transshipment in the IATTC Convention Area. An already complex practice, at-sea transshipments are further complicated by a lack of information and oversight - impacting the ability to effectively govern the activity of carriers operating on the high seas. Disparate information on observer trips and carrier vessel activity in the Convention Area leads to an increased risk of reduced transparency.

The IATTC ROP transshipment information differed from the MRAG transshipment report. This not only complicates attempts to validate reported activity, but also undermines the process of reporting transshipment activity to the Secretariat. Through AIS analysis, GFW detected

potentially unreported activity in the eastern portion of IATTC, including the overlap with WCPFC’s Convention Area. Finally, the majority of ports visited by carriers after an AIS detected encounter were located in countries which were either not members of IATTC, or were not party to the FAO’s Port State Measures Agreement. This increases the risk of IUU caught fish entering port.

In response to these findings, IATTC should consider the following recommendations:

Finding	Recommendation
<ul style="list-style-type: none"> <li>● There were discrepancies in transshipment information provided by MRAG and the IATTC ROP, complicating efforts to analyze or validate reported transshipments.</li> </ul>	<ul style="list-style-type: none"> <li>● Adopt consistent standards for reporting across all observer reports.</li> <li>● Publish a consolidated trip report focused on a single calendar year inclusive of up-to-date flag State, registry, and transshipment location information during observer trips, OR</li> <li>● Make the individual observer reports and annual transshipment reports from CPCs publicly available to allow for analysis and validation by third parties, and improve overall transparency of transshipment activity in the Convention Area.</li> </ul>
<ul style="list-style-type: none"> <li>● Unreported carrier activity was detected in the eastern IATTC Convention Area</li> </ul>	<ul style="list-style-type: none"> <li>● Investigate further and consider using AIS data to support the centralized VMS program to identify unreported activity.</li> </ul>
<ul style="list-style-type: none"> <li>● A significant amount of the detected carrier activity occurred in IATTC-WCPFC Overlap Area</li> </ul>	<ul style="list-style-type: none"> <li>● Strengthen the MOU with WCPFC to improve information sharing regarding transshipment activity</li> <li>● Ensure training and certification, including cross certification of carrier observers is present in both RFMOs.</li> </ul>
<ul style="list-style-type: none"> <li>● Half of all ports visited by carriers after encounters are within non-member States</li> <li>● Half of all ports visited by carriers after encounters are in countries which are not party to the PSMA</li> </ul>	<ul style="list-style-type: none"> <li>● Adopt a measure on minimum port inspection standards, in line with the minimum standards for port inspections included within the FAO PSMA.</li> <li>● Ensure effective information sharing with non-member States to ensure port landing information is shared with the Secretariat.</li> </ul>

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## Annex 1. Detailed Methodology

### *AIS-based data methods*

Carrier vessels registered at 300 gross tons or more, and on international voyages are already required to broadcast on Automatic Identification System (AIS), as mandated by the International Maritime Organization (IMO) (IMO 2015). 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 carrier vessels, 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).



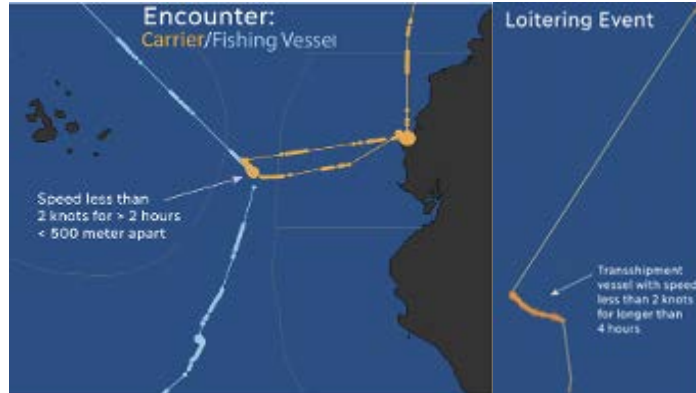


Figure A1 - Examples of vessel tracks during typical 'Encounter' where two vessels meet at sea and 'Loitering' events where a carrier vessel (referred to as transshipment vessel) has behavior consistent with encountering an LSTLV at sea but no LSTLV is visible on AIS

The GFW database also contains an estimate of port visits conducted by carrier vessels (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 carrier vessels 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 carrier vessels. 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 vessel gear types 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 the [International Telecommunication Union](https://www.itu.int/) 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. In addition loitering events were restricted to those that are  $\leq 24$  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.

The fishing hours by vessels occurring prior to encounter events were identified if the fishing vessel potentially fished within 3 weeks of the encounter and after any previous encounter or port visit. Potential 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).



The IATTC provides a public registry of authorized carrier and longline vessels, however the registry does not provide historical data with explicit date ranges of authorization in 2018. 2018 IATTC carrier registry data was provided by the IATTC Data Collection and Database Program upon request to identify possible authorization of these vessels. In addition, GFW used the carrier IATTC documents CAF-06-03 CORR, CAF-07-03, and CAF-07-03 Addendum 1 that list carrier vessel trips to identify carrier authorization. IATTC and other RFMOs should consider improving access to publicly available historical vessel authorization lists to enable a complete and more accurate picture of authorized vessel patterns and movements to all stakeholders in a fishery and ensure effective monitoring and control of fishing activities occurring inside respective Convention Areas.

#### Data caveats

The analysis presented in this report relies on commercially available AIS data and publicly available information. Therefore, AIS data is limited by those vessels that transmit on AIS and do so by providing accurate vessel identity information. Low satellite coverage or high-density areas can also limit AIS data usefulness, although the IATTC Convention Area has relatively strong Class-A AIS coverage (see Taconet, Kroosdma, and Fernandes 2019). However, AIS data tends to be sparser and more limited for vessels equipped with a Class-B AIS device (Taconet, Kroosdma, and Fernandes 2019; Kroosdma et al. 2018). 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 accurate as possible but should be considered restrained estimates based on these limitations (see Kroosdma et al. 2018, Miller et al. 2018, and <https://globalfishingwatch.org/> for further discussion).