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A COMPARATIVE ANALYSIS OF AIS DATA WITH REPORTED TRANSSHIPMENTS OCCURRING IN THE WESTERN AND CENTRAL PACIFIC FISHERIES COMMISSION CONVENTION AREA IN 2018

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Submitted by the Pew Charitable Trusts

Global Fishing Watch

A Comparative Analysis of AIS Data with Reported Transshipments Occurring in the Western and Central Pacific Fisheries Commission Convention Area in 2018

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Prepared by: Global Fishing Watch

AIS-Detected Transshipment Activity Occurring in the Western and Central Pacific Fisheries Commission Convention Area in 2018

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 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 occurring. 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.

Utilizing 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 2017-2019 inclusive.

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 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 available for the analysis. 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.

Contents

List of Acronyms

AIS – Automatic Identification System
WCPFC – Western and Central Pacific Fisheries Commission
NPFC – North Pacific Fisheries Commission
IATTC – Inter-American Tropical Tuna Commission
CMM – Conservation and Management Measure
CCM – Cooperating Non-Members and Participating Territories
CVP – Carrier Vessel Portal
EEZ – Exclusive Economic Zone
GFW – Global Fishing Watch
IUU – Illegal, Unreported, and Unregulated
LSTLFV – Large-Scale Tuna Longline Fishing Vessel
MCS – Monitoring, Control and Surveillance
PSMA – Port State Measures Agreement
RFMO – Regional Fisheries Management Organization
ROP – Regional Observer Programme
VMS – Vessel Monitoring System
DPE – Designated Port of Entry
SIDS – Small Island Developing States
PNA – Parties to the Nauru Agreement
FFA – Pacific Islands Forum Fisheries Agency

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 Western and Central Pacific Fisheries Commission (WCPFC) Convention Area is managed by the Conservation and Management Measure (CMM) on the Regulation of Transhipment, CMM 2009-06. This Measure includes reporting requirements for both carrier and fishing vessels to help deter Illegal, Unreported, and Unregulated (IUU) fishing activities and better manage the fishery. Additionally, this CMM requires that all carriers transshipping WCPFC-managed species be authorized by WCPFC and carry a WCPFC observer on board. The Measure acknowledges that while transshipment is an important part of the global fishing industry, "*unregulated and unreported transhipment of catches of highly migratory fish stocks at sea, in particular on the high seas, contributes to distorted reporting of catches of such stocks and supports IUU fishing in the Convention Area*".

Last year, GFW submitted a report to the 16th Regular Session of the Commission in which commercially available Automatic Identification System (AIS) data was used to analyze the track histories of carrier vessels operating within the WCPFC Convention Area during the calendar year 2017. This year, GFW analyzed carrier vessel activity in the Convention Area that occurred 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 WCPFC CMM for the Regulation of Transhipment and considers what improvements might be required to better detect and deter unauthorized transshipments or transfers of IUU-related catch sourced from the WCPFC Convention Area. Overall, AIS analysis suggests that despite the size of the Convention Area and the scale of fishing effort within it, WCPFC appears to have the fewest instances of potentially unauthorized activity by carrier vessels of all five tuna RFMOs in 2018. However, to further improve this trend, this report identifies four areas where further improvement might be considered:

- A quarter of all AIS encounters analyzed in the WCPFC Convention Area occurred in the overlap area with IATTC Convention Area waters. Analysis of fishing effort before these encounters suggests that these encounters are likely related to the transfer of catch sourced from IATTC waters or from dually managed waters, highlighting the importance of cross-certification of observers through both the WCPFC and IATTC Regional Observer Programs (ROPs).

- The number of transshipments reported by individual members' in their annual reports and the number of transshipments directly reported by the vessels themselves as compiled and reported through the WCPFC annual report differed. This lack of consistency undermines efforts to make transshipment at sea more transparent and complicates attempts to validate reported information against observed data using additional data sources such as VMS and AIS.

- Purse seine vessels are prohibited from transshipping with carrier vessels at sea per the WCPFC Conservation and Management Measure (CMM) 2009-06 *Regulation of Transhipment* unless these vessels receive an exemption from the Commission. AIS

analysis indicated a number of at-sea encounters between carriers and purse seine vessels which occurred in waters of several different coastal States within the Convention Area. These encounters, detected on AIS, are monitored and likely low risk for unauthorized transshipments of catch. However, increased transparency of all authorized transshipments would help strengthen the control systems. Reporting activity other than the transfer of WCPFC-managed catch, or transshipments involving purse seine vessels with an authorized exemption to transship at sea, would help States and stakeholders identify when encounters were conducted outside the scope of the CMM 2009-06, and were not in compliance with Commission Regulations.

- Finally, WCPFC's CMM 2017-02 on *Minimum Standards for Port State Measures* is an opt-in only measure, meaning members do not have to participate in the CMM if they choose not to designate any ports. Therefore, the standard of port State controls varies across Member port States within the Convention Area. Subsequently, while Member States' ports were the only ports visited by carriers after an observed encounter, not all Members designated a port of entry. This results in carriers being held to inconsistent standards or reporting requirements when entering port after an encounter and unnecessarily complicating the management regime.

WCPFC should consider the following recommendations to improve the management and oversight of transshipment activity at sea within the Convention Area:

Finding	**Recommendation**
• A quarter of AIS detected encounters in WCPFC occurred in the IATTC-WCPFC Overlap Area.	• Ensure carrier observers are properly certified for monitoring transshipments at-sea for both WCPFC and IATTC, and expand this training to cross certify carrier observers between WCPFC and IATTC. • As some of these encounters may be related to activity other than the transfer of WCPFC-managed catch, increase observer coverage on longline vessels to ensure their activities are legal and verifiable and facilitate proper reporting of these activities.

Finding	Recommendation
● Differences in reported number of transshipments conducted by Member States' annual reports and vessel reporting as compiled in the WCPFC Annual Report on Transhipment.	● Improve reporting requirements to ensure consistency across all annual reports. ● Require date, time and geolocation information for all transshipment reports. ● Use supplemental data such as AIS, in conjunction with VMS data, to fill in information gaps where necessary.
● AIS-detected encounters between carrier vessels and purse seine vessels in coastal States' EEZs after the purse seine vessel appeared to have fished inside EEZs.	● Member States that had AIS detected encounters inside their EEZs may want to consider investigating this activity to ensure no non-compliance occurred.
● AIS data indicated that carriers only visited ports in Member States after encounters with longline vessels. However, WCPFC's CMM 2017-02 on Minimum Standards for Port State Measures is opt-in only, and therefore carrier vessels are subject to inconsistent inspection schemes when landing catch in Member ports.	● WCPFC should encourage implementation of stronger port State measures across all Member States.

Activity Overview

High seas overview

GFW identified 1,234 encounters in the WCPFC Convention Area in 2018. These encounters involved 86 carriers and 455 fishing vessels. Additionally, a total of 154 carriers were observed undertaking 1,592 loitering events in the Convention Area which were unmatched[1] to encounters (Figure 1).

[1] 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

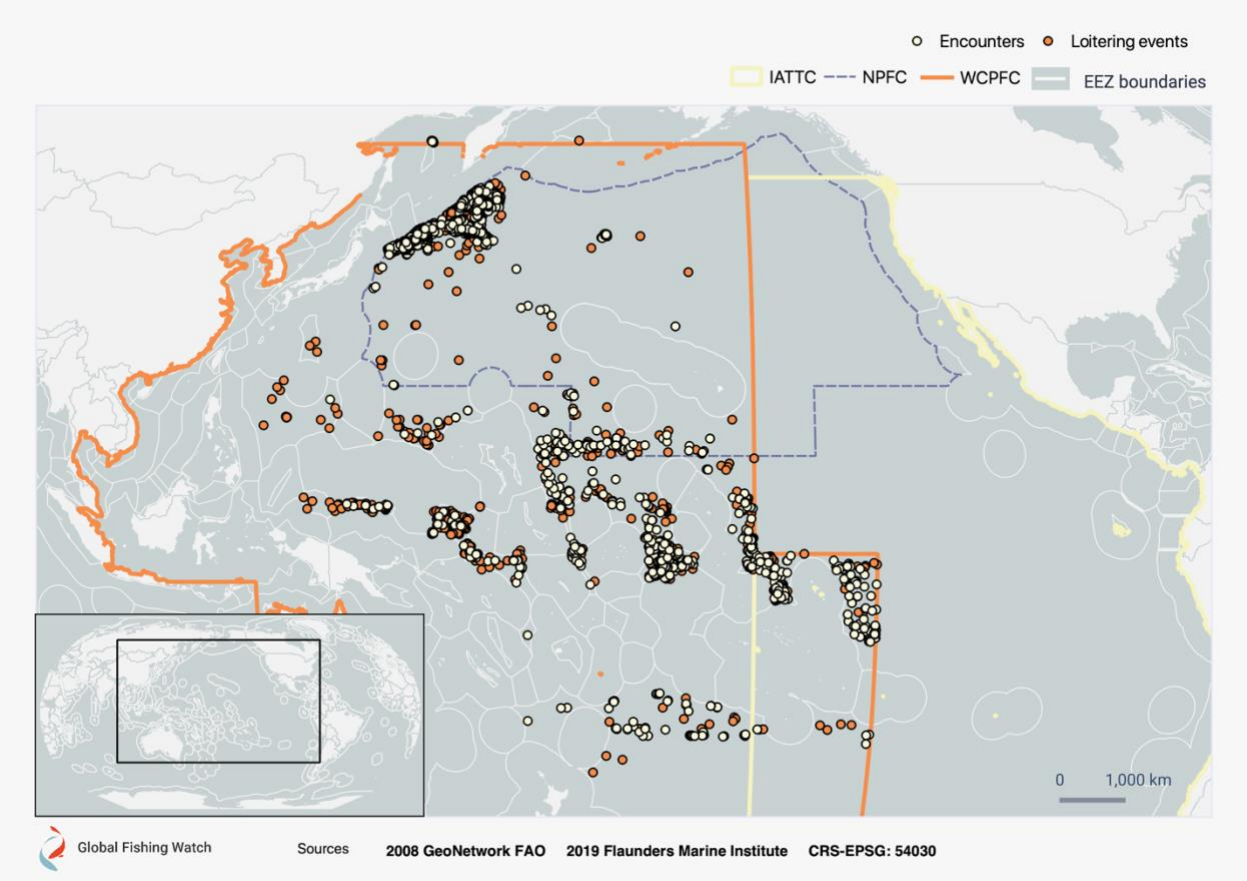

Figure 1. Possible high seas transshipment activity conducted by carriers in the WCPFC

A large number of the encounters were conducted in the northern portion of the Convention Area, north of 32 degrees latitude, where these waters overlap with that of the North Pacific Fisheries Commission (NPFC). In fact, 48.5% of all AIS detected encounters were conducted in these overlapping waters (599 of the 1,234 encounters) and 69.1% of all AIS detected loitering events were conducted in the same region (1,100 of the 1,592 loitering events). None of these encounters occurred between carriers and identified longline vessels, and both encounters and loitering events occurred in areas not identified as WCPFC transshipment locations (see WCPFC Annual Report figure 5 for location of reported WCPFC transshipments). Subsequently, encounters and loitering events north of 32 degrees North latitude in the NPFC overlap were removed from the analysis to focus on likely transshipments involving tuna, and other WCPFC-managed species.

Although the bulk of activity that occurred in the overlap between NPFC and WCPFC was removed from further analysis, 58 encounters and 51 loitering events that occur in this overlap area were included. To ensure a more complete understanding of carrier activity in the overlap

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).

waters and that transshipments are compliant, it is critical NPFC and WCPFC establish an information sharing agreement such as the MoU established with SPRFMO[2].

High seas encounters

The remaining 632 encounters were conducted by 28 carriers and 291 drifting longline vessels (Figure 2). Three encounters involving purse seine vessels were detected on the high seas within the WCPFC Convention Area but were not included in the analysis[3].

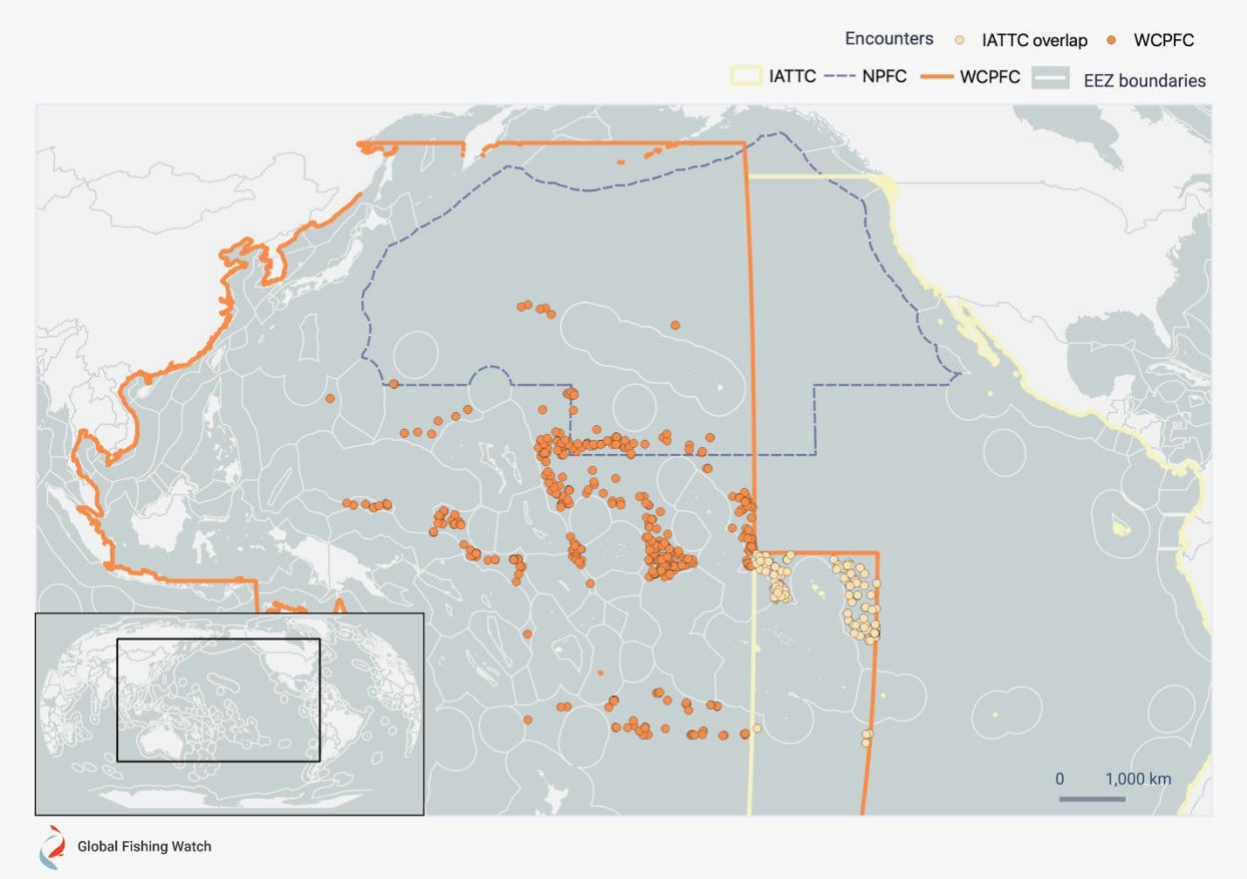

Figure 2. AIS-detected encounters between carriers and drifting longline vessels in the WCPFC and IATTC-WCPFC overlap

Of the 632 encounters, 158 were conducted within waters that overlap with the Inter-American Tropical Tuna Commission's (IATTC) Convention Area, shown in Figure 2 in yellow. These encounters, while likely related to the transfer of tuna, a species managed by both WCPFC and IATTC, were largely associated with fishing effort which occurred either entirely in the overlap

[2] https://www.wcpfc.int/doc/mou-between-sprfmo-and-wcpfc

[3] Two of the three purse seine vessels did not appear to fish prior to the encounters. While one of the purse seiners may have fished, it was assessed that these types of encounters may occur for purposes not related to transshipment (e.g. exchange of crew or salt) and furthermore, purse seine vessels are usually well monitored by observers.

area with IATTC or in waters managed only by the IATTC (Figure 3). Indeed, all encounters inside the overlap area appeared to occur during documented recorded IATTC observer trips except for encounters by one carrier which was authorized by IATTC but whose encounters occurred during two trips that were not identified as ROP reported trips[4].

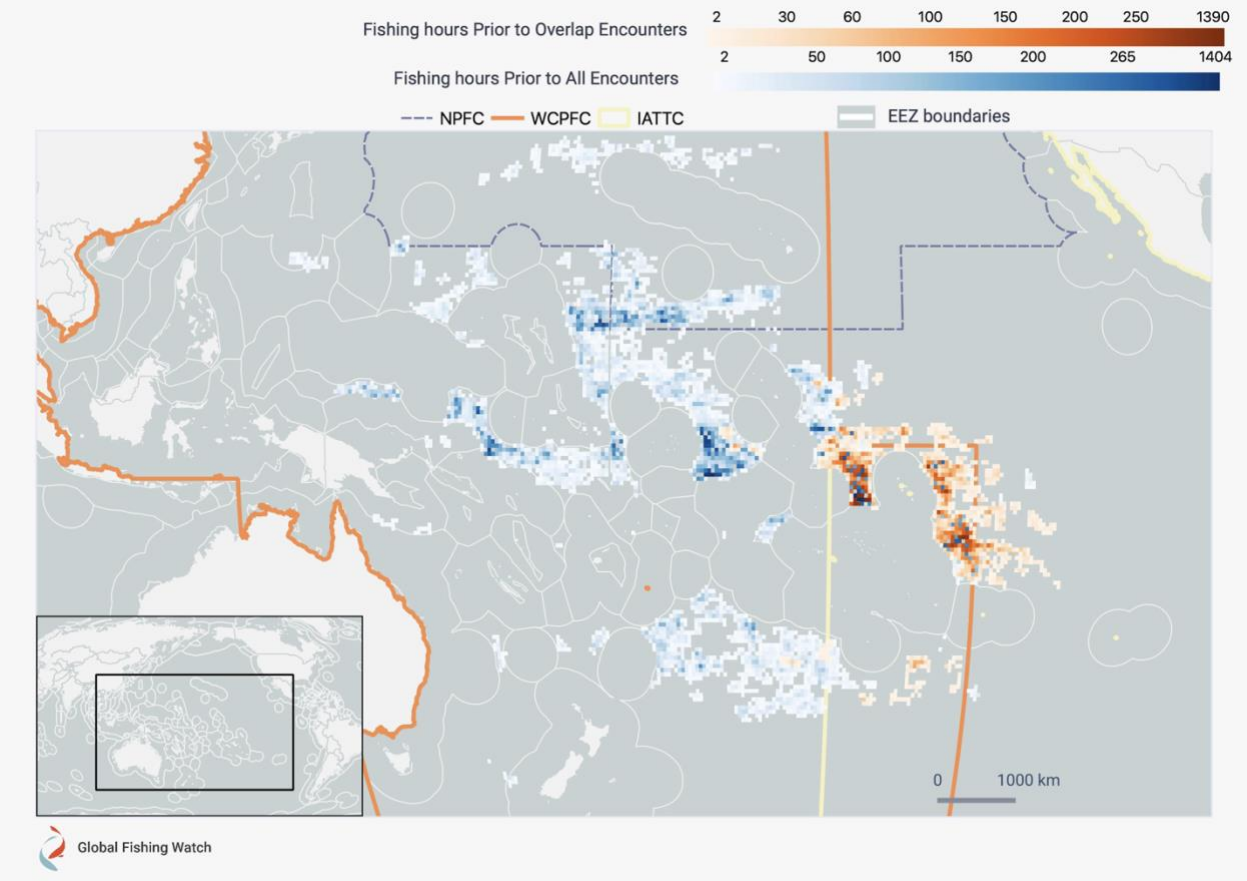

Figure 3. Fishing hours prior to encounters in the IATTC-WCPFC overlap area

Activity by fishing vessels prior to encounters in the IATTC-WCPFC overlap area is shown as a gradient of effort, with more activity shown by the darker shadings of blue and orange and less activity shown by the lighter shadings (Figure 3). The blue gradient is linked to fishing hours that occurred in WCPFC waters prior to all encounters while the orange gradient is linked to fishing hours prior to encounters that occurred in waters within the overlap area. Based on an assessment of fishing effort by vessels prior to encounters with carriers within the overlap, it is clear that these encounters were most likely related to the transfer of catch sourced strictly from IATTC waters or of catch that was sourced from waters that are co-managed by both IATTC and WCPFC. Clear and transparent processes and protocols for how catch sourced from the overlap area is reported and attributed to which management regime should be agreed upon by both WCPFC and IATTC. For more information on this activity, please see the GFW IATTC

[4] For more information, please see the GFW IATTC 2018 Transshipment report https://globalfishingwatch.org/rfmo-transshipment/

2018 annual report on transshipment[5]. To improve reporting of transshipments in the overlap area, WCPFC should work on a standardized training program for observers aboard WCPFC carrier vessels. Furthermore, WCPFC should work with IATTC to cross certify observers across both RFMOs.

High seas loitering events

GFW also analyzed loitering events in the Convention Area which were not matched to encounters. An additional 492 loitering events were conducted by 92 carrier vessels from 11 flag States that were not matched to encounters (Figure 4). Of the 492 loitering events, 68 occurred within the IATTC-WCPFC overlap area shown in Figure 4 in yellow.

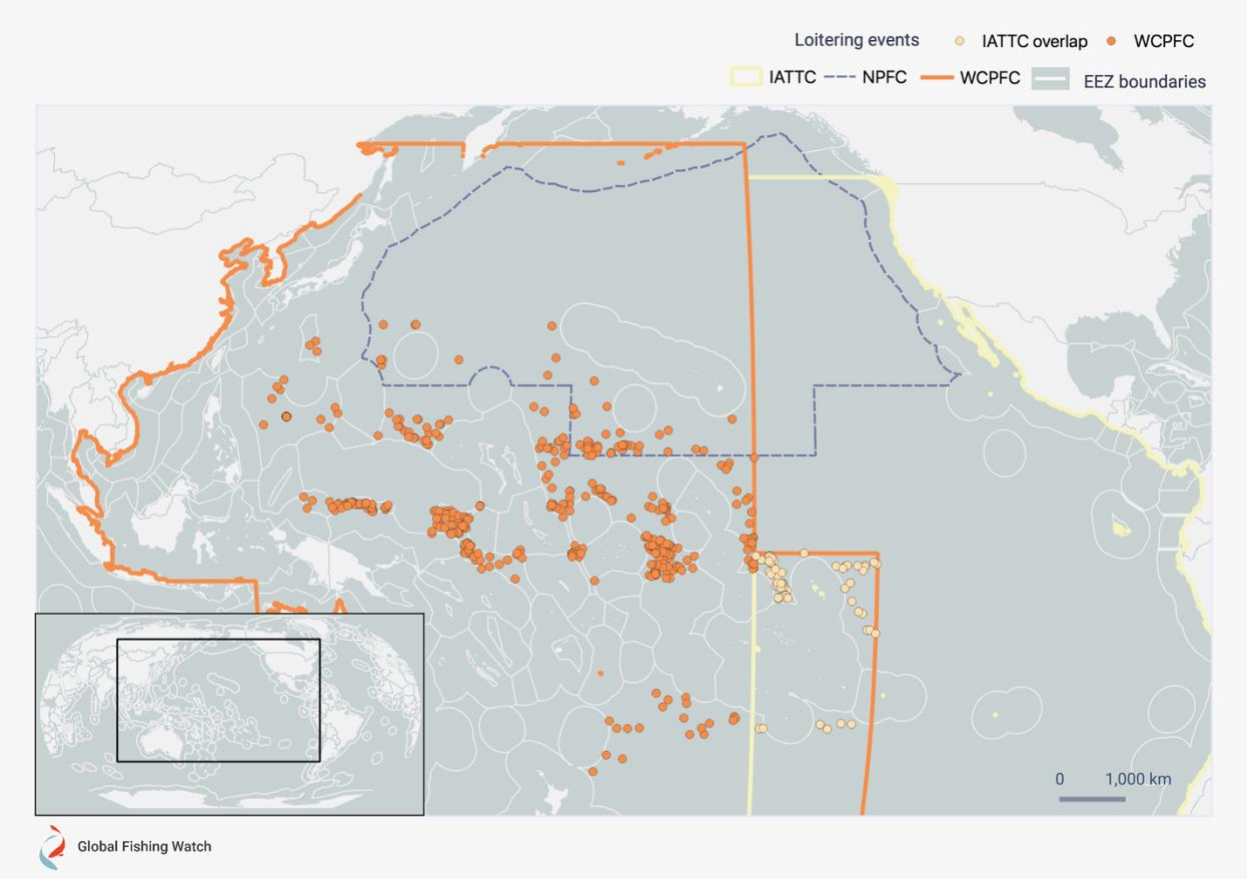

Figure 4. AIS-detected loitering events in the WCPFC and IATTC-WCPFC overlap area

Reported vs observed activity

GFW compared the AIS detected encounters and loitering events against the number of events that were compiled and reported within the WCPFC Annual Report on Transhipment (Figure 5).

[5] For more information, please see the GFW IATTC 2018 Transshipment report https://globalfishingwatch.org/rfmo-transshipment/

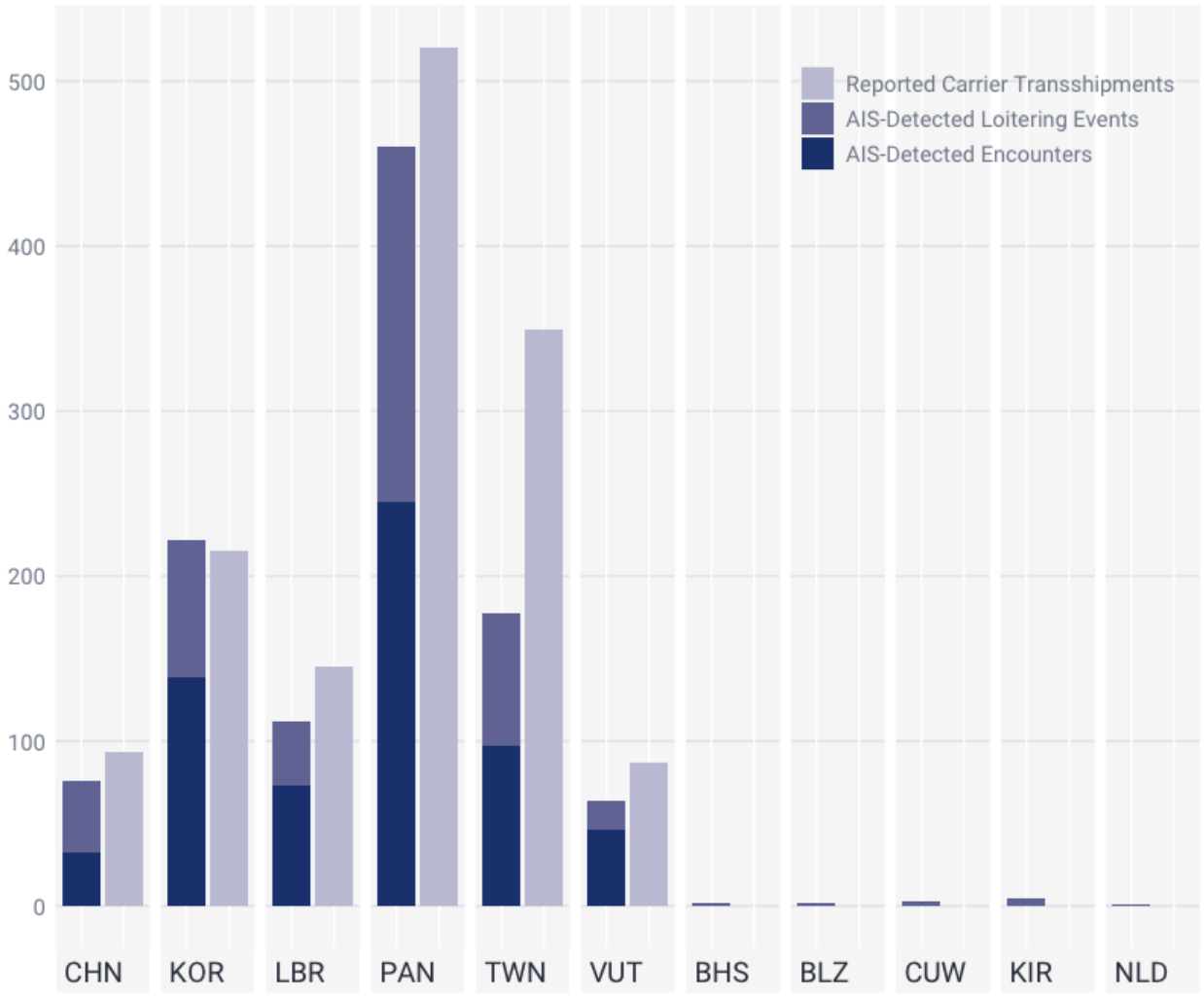

Figure 5. Comparison of WCPFC Reported Authorized Carrier Activity and AIS Detected High Seas Activity

While Figure 5 above does indicate fewer detected encounters than transshipments that were reported in 2018, this is to be expected as encounters are only counted when both the carrier and fishing vessel transmit on AIS. When loitering events are included in the analysis, the numbers are much closer.

South of 32 degrees North latitude, GFW identified 632 encounters and 492 loitering events. These numbers represent a total of 1,124 potential transshipments to have occurred involving 92 unique carriers flagged to 11 different flag States.
The encounters were conducted between 28 carrier vessels from six flag States and 291 longline vessels from five different flag States (Figure 6).

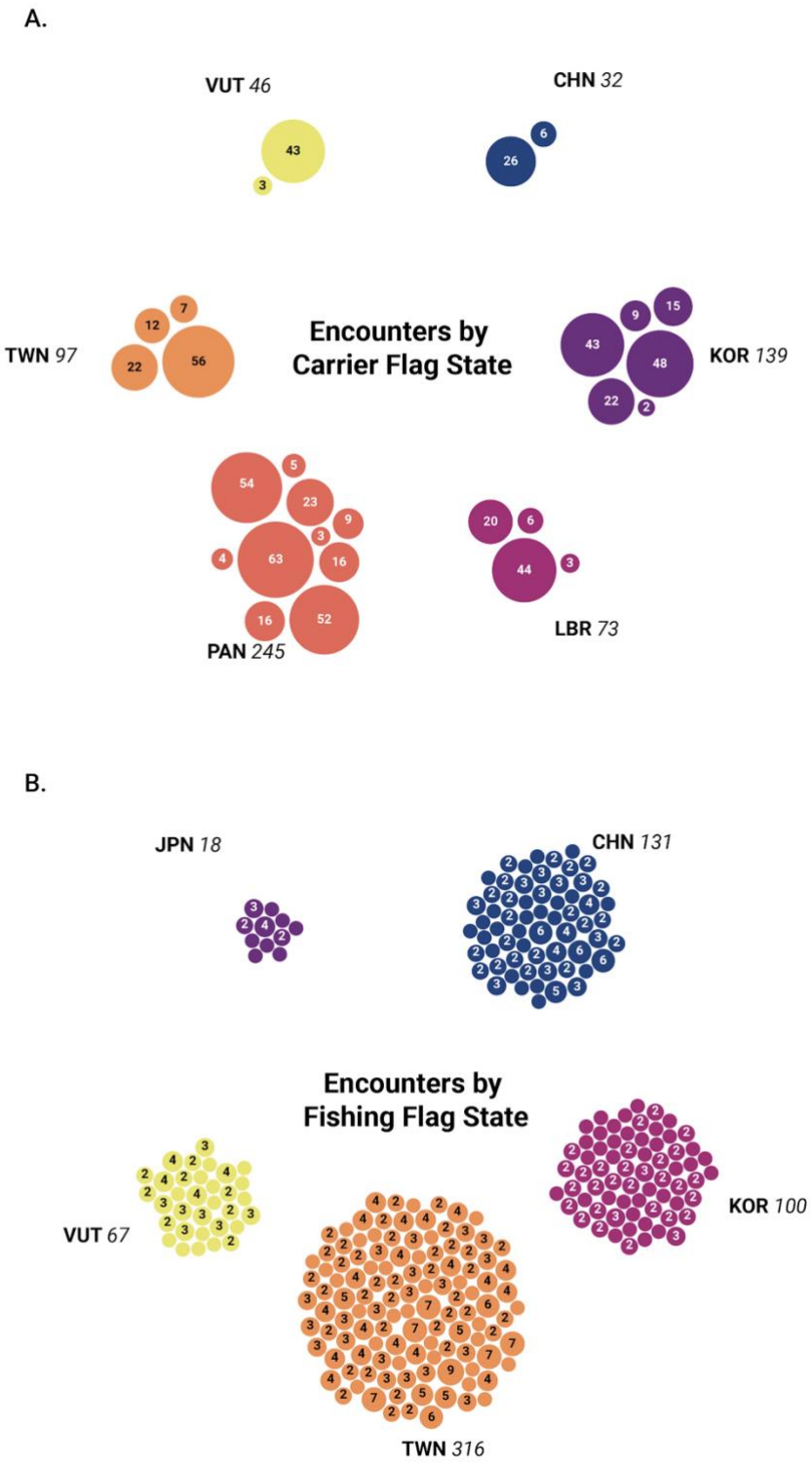

Figure 6A. GFW-detected Encounter Events by Carrier Flag State and 6B. Fishing vessel Flag state. Note: bubbles indicate unique carriers or fishing vessels

The 492 loitering events were conducted by 92 carriers across 11 flag States (Figure 7). All of the 28 carriers linked to AIS-detected encounters in WCPFC waters in 2018 were also linked to loitering events.

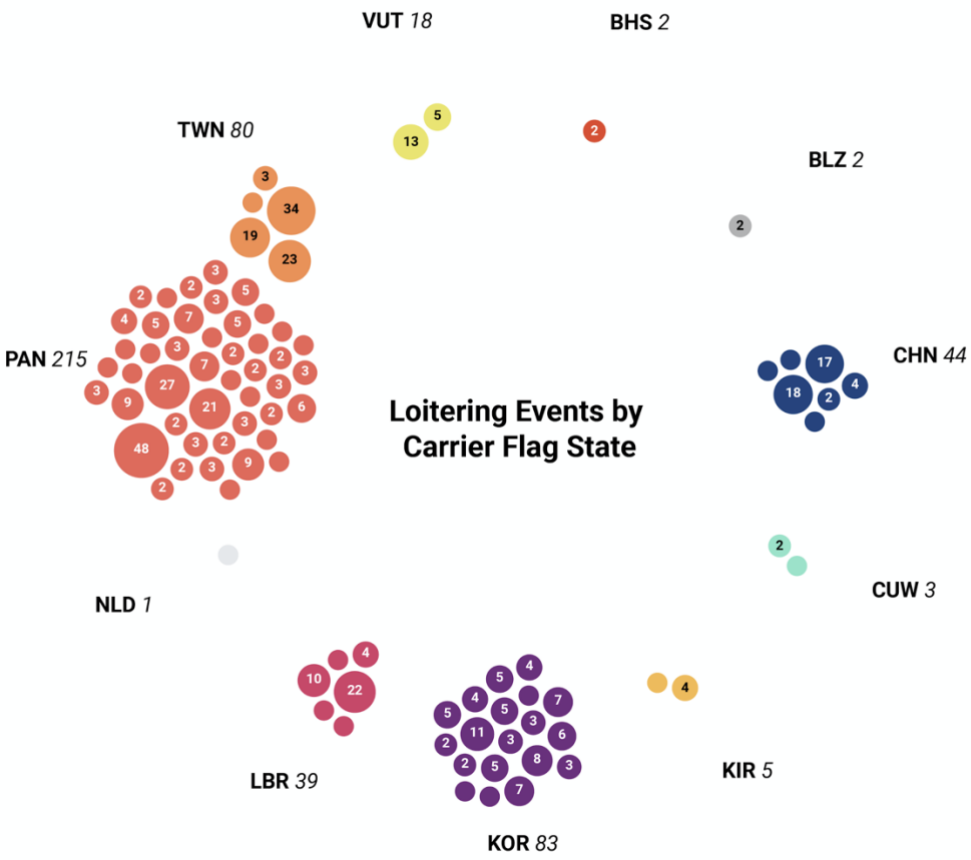

Figure 7. GFW-detected Loitering Events by Carrier Flag state. Note: bubbles indicate unique carriers

Comparatively, the WCPFC Regional Observer Programme (ROP) identified 1,409 transshipments to have occurred in 2018 which were conducted by 29 carrier vessels and 486 fishing vessels[6]. These vessels were all flagged to the same flag States as those detected by AIS data (Figure 8). The WCPFC Annual Report on Transhipment provides transshipment data as aggregated count data compiled from both Member annual reports as well as directly from vessel transshipment declarations. However, WCPFC does not provide specific transshipment geolocation data for each reported event. As such, it is not possible to definitively match the reported transshipments to AIS-detected encounters.

[6] See Table 4 in WCPFC 2018 Annual Report

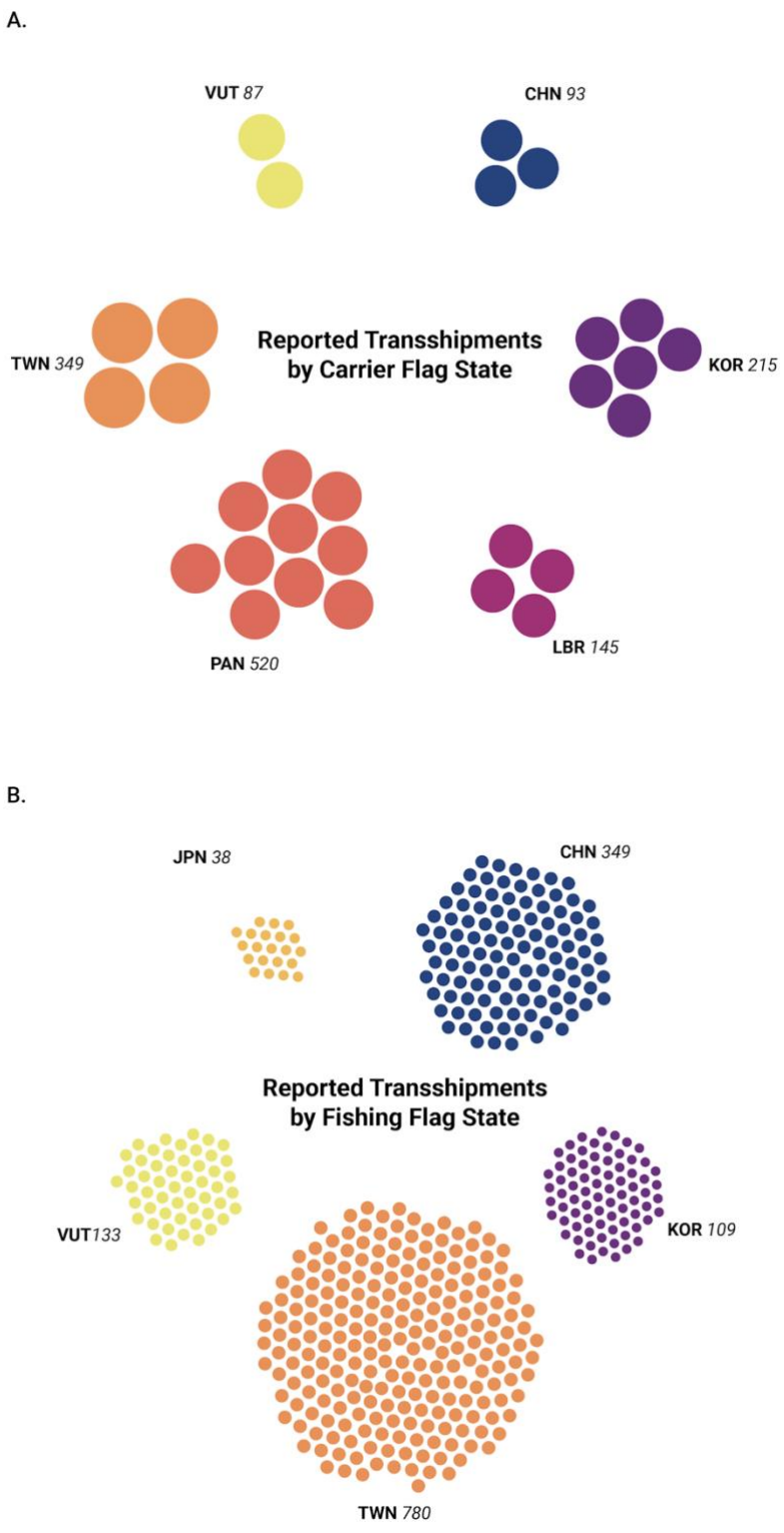

Figure 8 A1. WCPFC 2018 Annual Report on Transhipment figures for number of transshipments by Carrier Flag State and B. Fishing vessel Flag State. Note: bubbles indicate unique carriers or fishing vessels

Variance between reported figures

In an effort to compare reported transshipment activity with AIS detected encounters, GFW analyzed both the WCPFC 2018 Annual Report on Transhipment compiled by the Secretariat as well as the annual reports submitted by each of its Members. In doing so, there were discrepancies noted in the number of transshipments as reported by the flag States and the numbers compiled in the WCPFC Annual Report whose data source are the transshipment declarations submitted by carrier vessels when reporting a transshipment event. This report compares reported transshipment data from the WPFC Annual Report to AIS detected encounters and loitering data.

Table 1. Comparison of WCPFC transshipment activity from 2018 annual report and transshipment data from Flag State CCM Annual Reports

CMM Country	Table 4 annual report[7]				Member country reports[8]			
	Count of vessels in reports received		Count of reported transshipment events		Count of vessels in reports received		Count of reported transshipment events	
	As receiving vessels	As offloading vessels	Receiving vessel	Offloading vessel	As receiving vessels	As offloading vessels	Receiving vessel	Offloading vessel
China	3	109	93	349				344
Japan		21		38				16
Republic of Korea	6	76	215	109			185	90
Liberia	4		145		4		144	
Panama	10		520				49	
Chinese Taipei	4	228	349	780			360	741
Vanuatu	2	52	87	133				192

While annual report figures from Liberia, China, and Chinese Taipei are reasonably aligned with those in the WCPFC Annual Report, other Member's numbers, such as those reported by Panama, are significantly different. It is recognized that the numbers provided by Members and by WCPFC are not entirely comparable. For example, WCPFC's annual report provides information on transshipments which were reported to have occurred within the WCPFC and IATTC Convention Areas based on transshipment declarations submitted directly by carrier vessels, while Member reports provide information on transshipments which were reported by

[7] https://www.wcpfc.int/doc/wcpfc-tcc15-2019-rp03/annual-report-wcpfc-transhipment-reporting-secretariat

[8] For individual country reports, see https://www.wcpfc.int/meetings/sc15

the flag State to have occurred either “inside”, “outside” or “both inside and outside” the WCPFC Convention Area.[9]

Furthermore, while WCPFC’s annual report provides specific information on the number of fishing and carrier vessels involved in each CCM’s annual transshipment activity, in most cases these values are missing from the annual reports of the Member. Reasons for these reporting differences are unclear. Inconsistencies in reported information between Members and the Secretariat undermine efforts to improve oversight and transparency.

WCPFC is seeking to improve oversight of transshipment activity with increased use and analysis of VMS data and conducted a study using VMS data to identify potential transshipment events in the Convention Area that occurred during calendar years 2017-2019. The 2018 Secretariat Annual Report stated “*There were over 3,200 reported transshipment events that were reported to the Secretariat during the period covered by the analysis, but only 23% were detected by the WCPFC Transhipment Analysis Tool. The low number of events detected on VMS can be due to numerous factors such as the script for the detection tool may need to be tailored or the vessel was not reporting to VMS and this is something that the Secretariat will need to continue to explore*”[10].

Tools such as VMS are key in improving fisheries governance, but as the report identifies, there are still limitations to using VMS alone to monitor transshipment activity at sea. For example, the minimum VMS polling rate for longline vessels is once every four hours[11], while transshipment events can occur over shorter time periods[12]. This means that there may be instances where transshipment events are missed if VMS data alone were used to identify events. To support further transshipment analyses, the Secretariat should consider the use of supplemental tools and data, like AIS, to support their analysis of VMS data so as to gain a more complete and better understanding of transshipment behavior occurring within the Convention Area.

Overall, it is noticeable that despite the size of the Convention Area and the scale of fishing effort occurring within it, GFW AIS analysis suggests that WCPFC was subject to the fewest instances of potentially unauthorized activity by carrier vessels of all five tuna RFMOs in 2018. Although WCPFC already has the highest percentage of carriers with observers on board, achieving more consistent and comprehensive reporting would help compliance teams ensure that no unauthorized activity occurs.

Purse Seine Encounters Inside EEZs

[9] For the purposes of this report, GFW included only those transshipments which were reported by members which were conducted “inside” the Convention Area
[10] https://www.wcpfc.int/doc/wcpfc-tcc15-2019-rp03/annual-report-wcpfc-transhipment-reporting-secretariat
[11] https://www.wcpfc.int/doc/wcpfc-tcc15-2019-rp03/annual-report-wcpfc-transhipment-reporting-secretariat
[12] https://www.pewtrusts.org/en/research-and-analysis/reports/2019/09/transshipment-in-the-western-and-central-pacific

Pursuant to CMM 2009-06, "...*transhipment at sea by purse seine vessels shall be prohibited except in respect of exemptions granted by the Commission*…". Furthermore, any purse seine vessel granted permission by the Commission to transship at sea, is "...*prohibited from commencing transhipping on the high seas in the Convention Area*". GFW identified 32 encounters involving carriers and purse seine vessels that occurred within EEZs of Pacific Island States (Figure 9).

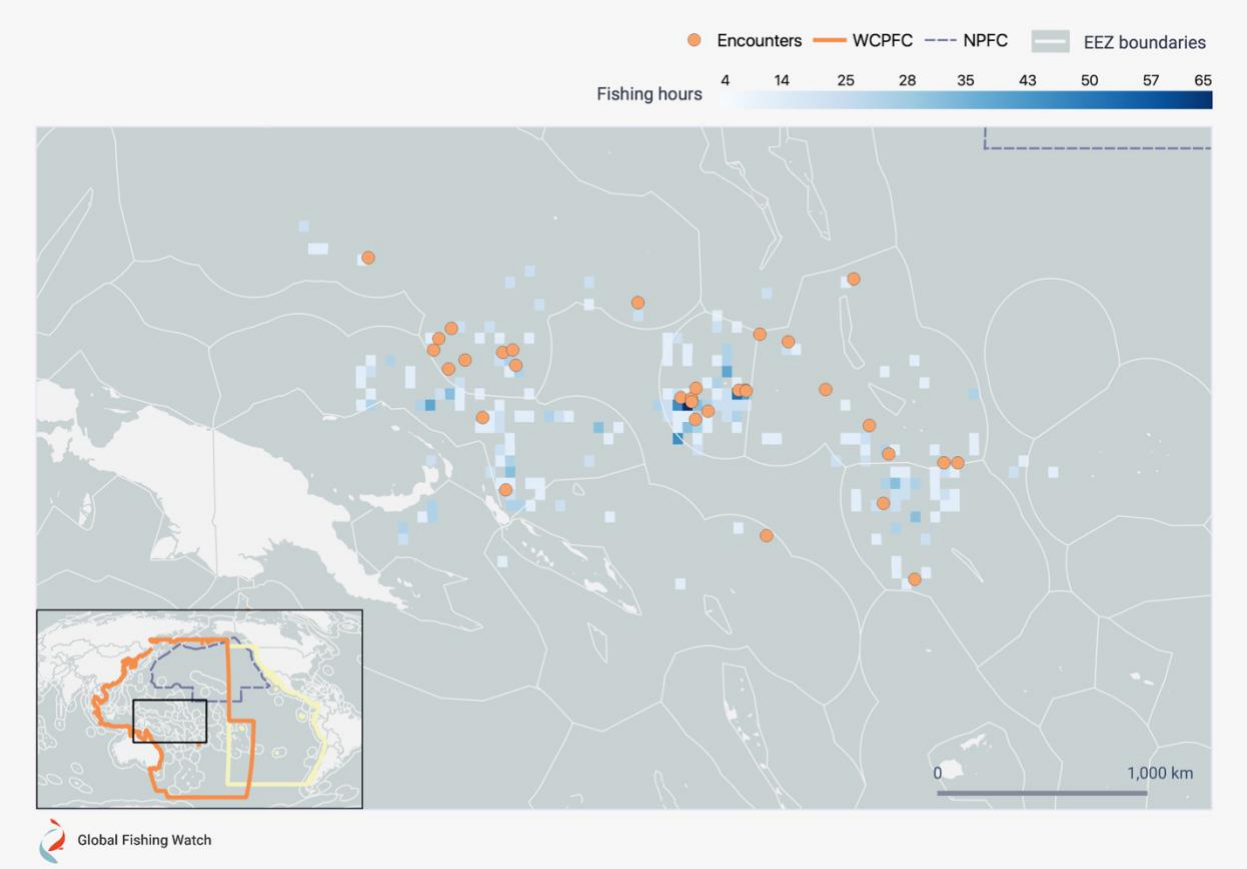

Figure 9. Map of purse seine fishing activity as a gradient of effort (light to dark blue) prior to AIS-detected at-sea encounter with a carrier vessel (indicated by orange marker)

In Figure 9, fishing activity is shown as a gradient of effort (measured by hours), where dark blue represents more hours spent fishing by the purse seine vessel prior to an encounter, and light blue represents fewer hours spent fishing. Although at-sea encounters between a purse seiner and carrier occur and are typically carried out for non-fish transshipments, AIS data confirms fishing does occur prior to these encounters which suggests the possibility that the transshipment of fish could occur. As such, AIS data can provide an additional means to validate what is being reported.

The encounters with purse seine vessels that occurred were largely conducted by carriers flagged to Panama, (29 out of 32 encounters) within the EEZs of the Federated States of Micronesia, Nauru, and Kiribati (Figure 10).

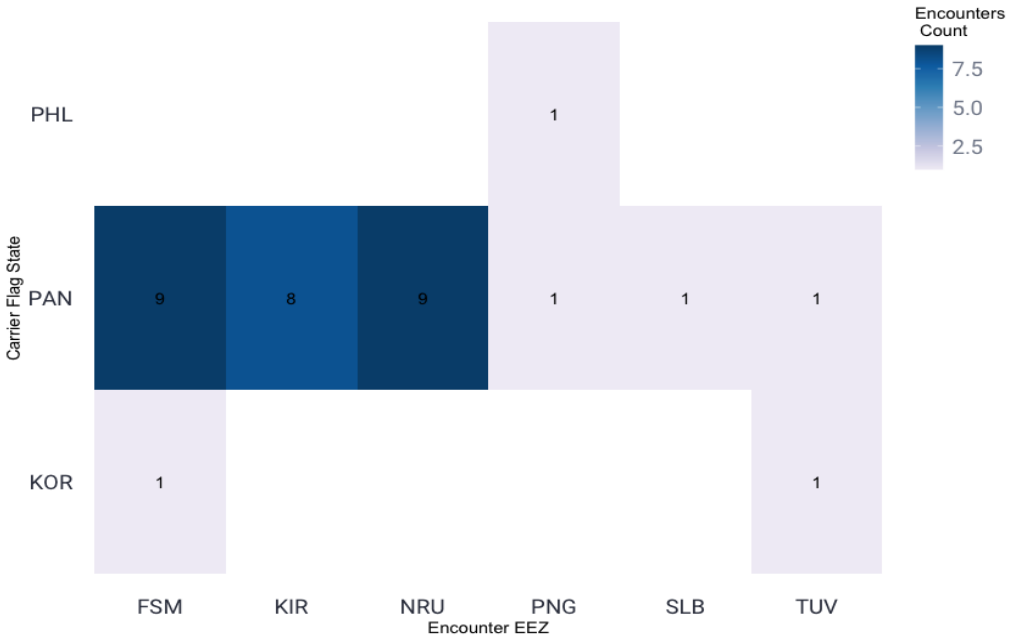

Figure 10. Number of encounters by carrier flag State and EEZ of coastal State where the encounter occurred

After EEZ-based encounters with purse seiners, the most frequently visited port States by carriers were the Federated States of Micronesia and Tuvalu (Figure 11).

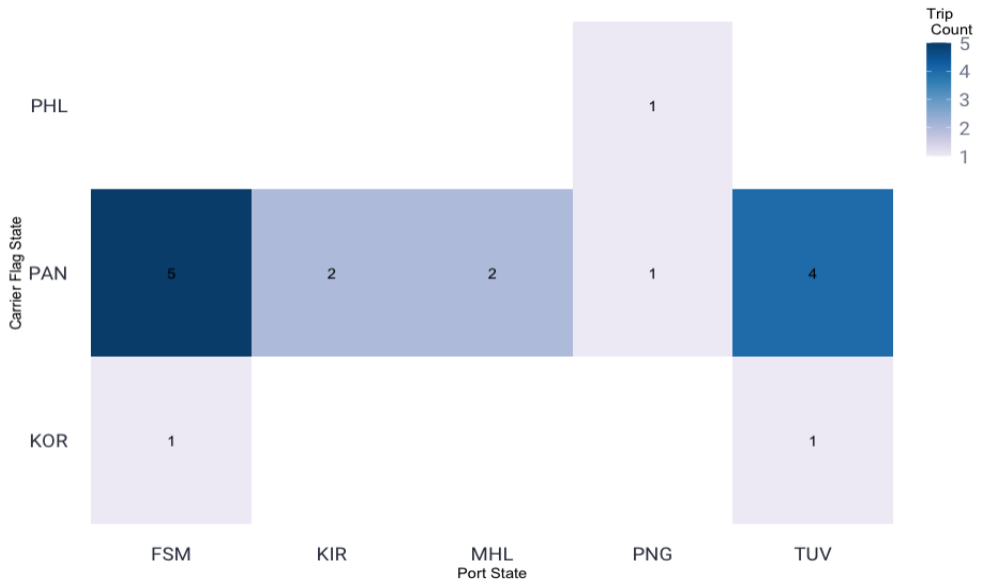

Figure 11. Number of trips by carrier flag State and port State

While there are reasons purse seine vessels and carrier vessels may meet up beyond the transfer of WCPFC-managed catch, it is still worth noting this activity to the Commission and to those Island States' which may have been impacted by this activity. These encounters, if related

to the transfer of catch, may not only be prohibited by CMM 2009-06 in the absence of an exemption, but may also be prohibited by coastal State regulations[13]. Members may want to consider using AIS alongside VMS and observer reports to investigate these activities further, to ensure no activity went unreported or occurred potentially in noncompliance with the WCPFC management measure or national requirements.

Port Dynamics

AIS data indicated twelve port States were visited by carriers after they had encounters with fishing vessels that were potentially catching WCPFC-managed species on the high seas (Figure 12). The most frequently used ports after an encounter were Kaohsiung, Chinese Taipei; Busan, Republic of Korea; and Papeete, French Polynesia.

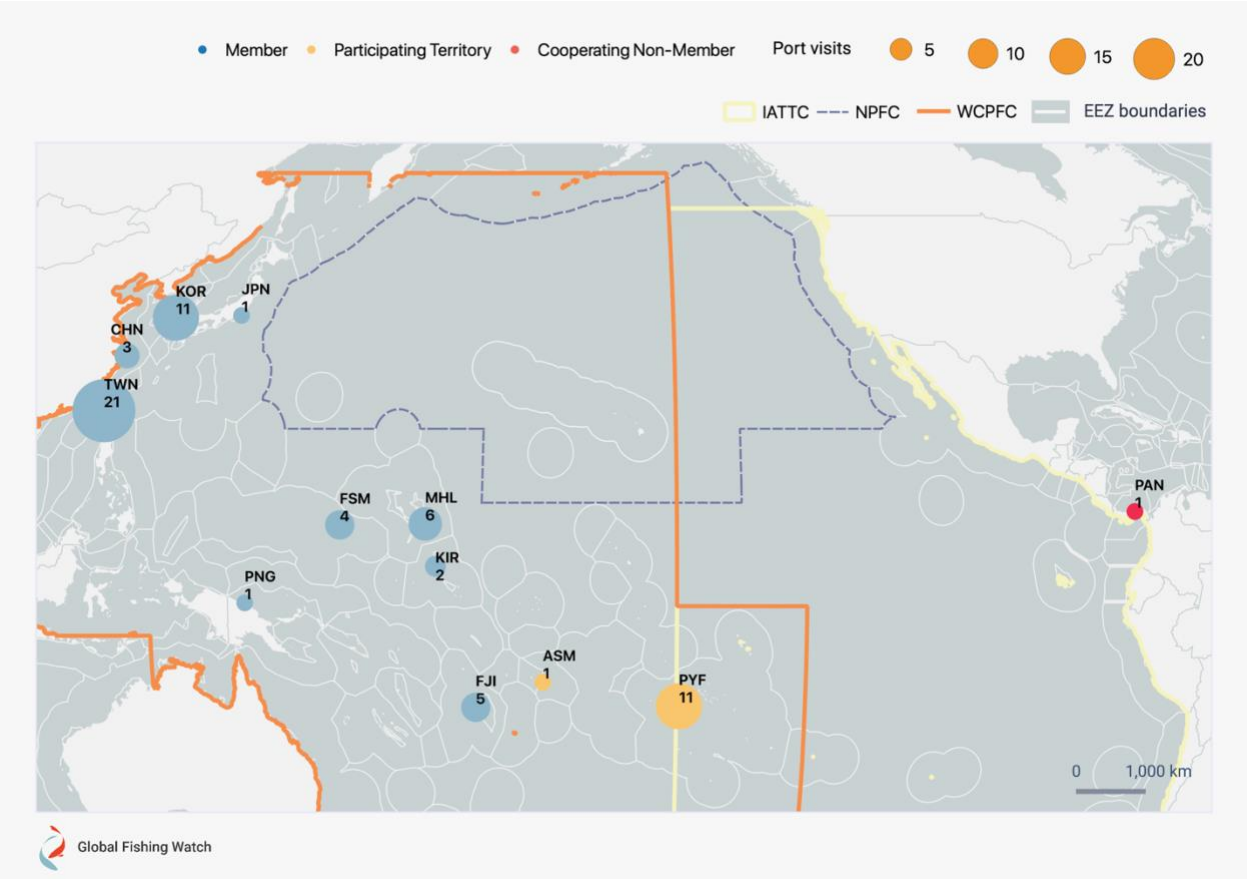

Figure 12. Count of port visits by carriers after AIS-detected encounter events within the WCPFC

[13] See 2nd PNA Implementing Arrangement https://www.pnatuna.com/content/2nd-pna-implementing-arrangement and FFA Harmonised Minimum Terms and Conditions for Access by Fishing Vessels https://www.ffa.int/system/files/HMTC_as_revised_by_FFC110_May_2019_-_FINAL.pdf

While carriers flagged to Republic of Korea and Chinese Taipei showed a preference for frequenting the ports of their own flag States, Chinese-flagged carriers were observed to not visit ports in China after an AIS-detected encounter (Figure 13).

Figure 13. Number of trips by carrier flag state and port state

Ports in Chinese Taipei, Federated States of Micronesia, and Fiji were used by the widest variety of fleets, though Chinese Taipei's ports were visited the most frequently (Figure 13). Chinese Taipei's port in Kaohsiung also saw the most visits by a single flag State's vessels - their own fleet - followed by Busan in Republic of Korea by Korean-flagged carriers and Papeete in French Polynesia by Panamanian-flagged carriers (Figure 13). Panamanian-flagged carrier vessels visited the most port States, followed by Korean-flagged carrier vessels (Figure 13).

While it is promising that these carriers are seemingly landing their transshipped catch at ports within the RFMO Convention Area from which the catch was sourced, WCPFC's CMM 2017-02 on *Minimum Standards for Port State Measures*, does not meet the internationally-agreed upon minimum standards for port State measures or the best practices for port controls in place within other RFMOs[14]. Additionally, CMM 2017-02 is an opt-in measure, and Members do not have to participate in the measure should they choose not to designate any ports.

Therefore, WCPFC should work towards more consistent coverage of port State measures. Some members are Parties to the FAO Port State Measures Agreement, while others have agreed to other strong port State measures developed at the regional or sub-regional level. To help those member States that are making efforts to implement strong port State controls, it is

[14] http://www.fao.org/port-state-measures/resources/detail/en/c/1111616/

therefore only fair that every port CCM implements the same requirements to ensure a minimum standard.

The table below provides details of each port visited by carriers after encounters in the Convention Area in 2018, including their designation as a port of entry under WCPFC and the FAO PSMA (Table 2).

Table 2. Ports visited by carriers after encounters in the WCPFC with information on number of visits and if port is designated as a port of entry

Port State	Port	PSMA[15]	PSMA DPE[16]	WCPFC DPE[17]	Carrier Visits
Chinese Taipei	Kaohsiung	No	No	No	21
Republic of Korea	Busan	Yes	No	No	11
French Polynesia	Papeete	Yes	No	Yes	11
Marshall Islands	Majuro	No	No	No	6
Federated States of Micronesia	Pohnpei	No	No	No	4
China	Zhoushan	No	No	No	3
Fiji	Suva	Yes	No	No	3
Fiji	Levuka	Yes	No	No	2
Kiribati	Tarawa	No	No	No	2
Japan	Yokosuka	Yes	Yes	Yes	1
Papua New Guinea	Wewak Harbor	No	No	No	1
American Samoa	Pago Pago Harbor	Yes	No[18]	No[19]	1
Panama	Panama City	Yes	No	No	1

Given that CMM 2017-02 is an opt-in only measure, some ports used by carriers to land WCPFC-managed catch are not required to comply with the measure, and therefore fish

[15] http://www.fao.org/treaties/results/details/en/c/TRE-000003/
[16] http://www.fao.org/fishery/port-state-measures/psmaapp/?locale=en&action=qry
[17] https://www.wcpfc.int/wcpfc-port-state-minimum-standards
[18] USA lists no ports as Designated Ports of Entry (DPE) http://www.fao.org/fishery/port-state-measures/psmaapp/?locale=en&action=qry
[19] USA lists no ports as DPE under WCPFC https://www.wcpfc.int/wcpfc-port-state-minimum-standards

products landed in those ports are not guaranteed a sufficient level of oversight to ensure that they do not originate from IUU fishing operations. Therefore, WCPFC should encourage port States whose ports are being used by carriers to opt in to the Measure, rather than have carriers land at ports which are further away, in compliance with paragraph 26 of CMM 2017-02, "*...CCMs shall… encourage the use of ports of SIDS in order to increase the opportunity to undertake inspections…"*.

Lastly, it is worth noting that paragraph 23 of CMM 2017-02 states that Members "*... shall cooperate to establish appropriate mechanisms to assist Developing CCMs, in particular SIDS in the implementation of this CMM, which may include the provision of technical and/or financial assistance through bilateral, multilateral, and regional cooperation channels"*[20]. Specifically, WCPFC has mechanisms in place to assist Small Island Developing States (SIDS) enhance capacity for "*...monitoring, control and surveillance and for training at the national and regional levels of port managers, inspectors, and enforcement and legal personnel; monitoring control, surveillance and compliance activities relevant to port State measures, including access to technology and equipment"*[21].

Based on the AIS data, it seems clear that there are ports in coastal Member States that would benefit from this capacity assistance as provided through CMM 2017-02, to complement existing sub-regional and national PSMs implementation efforts. It would be beneficial to these States if WCPFC had official data on port visits to corroborate the observed port visit data and help direct assistance funds as well as assess the effectiveness of the existing port State Measures CMM.

Conclusions and Recommendations

This analysis highlights the complicated nature of managing at-sea transshipment in the WCPFC Convention Area. With high levels of observed activity and reported transshipments in 2018, there is risk for potentially non-compliant behavior at-sea and in EEZs, that should be of concern to the Commission. For instance, AIS data detected encounters within EEZs conducted by carrier vessels and purse seine vessels, though purse seiners are prohibited, in the absence of an exemption, from at-sea transshipments in the Convention Area through the CMM 2009-06 *Regulation of Transhipment*.

The complexity of managing transshipment at-sea is further complicated by inconsistent reporting mechanisms by Members and the Commission, as well as difficulties in reporting transshipments in an area of overlapping waters with IATTC. Additionally, CMM 2017-02 *Minimum Standards for Port State Measures* is an optional measure, meaning carriers landing catch at Member Port States are subject to inconsistent port inspection schemes, or theoretically subject to no inspection requirements at all, which could have a detrimental effect

[20] https://www.wcpfc.int/doc/cmm-2017-02/conservation-and-management-measure-minimum-standards-port-state-measures
[21] https://www.wcpfc.int/doc/cmm-2017-02/conservation-and-management-measure-minimum-standards-port-state-measures

on market access for product passing through ports with controls perceived to be weaker than PSMA.

These key findings and corresponding recommendations for the Commission and Members to consider are provided in the table below:

Finding	Recommendation
● A quarter of AIS detected encounters in WCPFC occurred in the IATTC-WCPFC Overlap Area.	● Ensure carrier observers are properly certified for monitoring transshipments at-sea for both WCPFC and IATTC, and expand this training to cross certify carrier observers between WCPFC and IATTC. ● As some of these encounters may be related to activity other than the transfer of WCPFC-managed catch, increase observer coverage on longline vessels to ensure their activities are legal and verifiable and facilitate proper reporting of these activities.
● Differences in reported number of transshipments conducted by Member States' annual reports and vessel reporting as compiled in the WCPFC Annual Report on Transhipment.	● Improve reporting requirements to ensure consistency across all annual reports. ● Require date, time and geolocation information for all transshipment reports. ● Use supplemental data such as AIS, in conjunction with VMS data, to fill in information gaps where necessary.

Finding	Recommendation
● AIS-detected encounters between carrier vessels and purse seine vessels in coastal States' EEZs after the purse seine vessel appeared to have fished inside EEZs.	● Member States that had AIS detected encounters inside their EEZs may want to consider investigating this activity to ensure no non-compliance occurred.
● AIS data indicated that carriers only visited ports in Member States after encounters with longline vessels. However, WCPFC's CMM 2017-02 on Minimum Standards for Port State Measures is opt-in only, and therefore carrier vessels are subject to inconsistent inspection schemes when landing catch in Member ports.	● WCPFC should encourage implementation of stronger port State measures across all Member States.

Sources

FAO (2016). Agreement on Port State Measures to Prevent, Deter, and Eliminate Illegal, Unreported and Unregulated Fishing.

FFA (2019). The Harmonized Minimum Terms and Conditions for Access by Fishing Vessels - As amended by FFC110 (May 2019).

Global Fishing Watch, and The Pew Charitable Trusts (2019). A Comparative Analysis of AIS Data with the Western and Central Pacific Fisheries Commission Reported Transshipment Activity in 2017 (WCPFC16-2019-OP10). Available at: https://www.wcpfc.int/node/44709.

IMO (2015). Resolution A.1106(29) Revised guidelines for the on board operational use of shipborne automatic identification systems (AIS).

INTERPOL (2014). Study on Fisheries Crime in the West African Coastal Region. Environmental Security Sub-Directorate.

Kroodsma, D. A., Mayorga, J., Hochberg, T., Miller, N. A., Boerder, K., Ferretti, F., et al. (2018). Tracking the global footprint of fisheries. *Science* 359, 904. doi:10.1126/science.aao5646.

Miller, N. A., Roan, A., Hochberg, T., Amos, J., and Kroodsma, D. A. (2018). Identifying Global Patterns of Transshipment Behavior. *Frontiers in Marine Science* 5, 240. doi:10.3389/fmars.2018.00240.

PNA (1990). 2nd PNA Implementing Arrangement. Available at: https://www.pnatuna.com/sites/default/files/2nd%20Implementing%20Arrangement_0.pdf.

Taconet, M., Kroodsma, D., and Fernandes, J. (2019). Global atlas of AIS-based fishing activity–Challenges and opportunities.

The Pew Charitable Trusts Transshipment in the Western and Central Pacific.

WCPFC (2009). Conservation and Management Measure on the Regulation of Transhipment - CMM 2009-06.

WCPFC (2017). Conservation and Management Measure on minimum standards for Port State Measures - CMM 2017-02. Available at: https://www.wcpfc.int/doc/cmm-2017-02/conservation-and-management-measure-minimum-standards-port-state-measures.

WCPFC (2019a). Annual Report on WCPFC transhipment reporting - WCPFC-TCC15-2019-RP03. Available at: https://www.wcpfc.int/doc/wcpfc-tcc15-2019-rp03/annual-report-wcpfc-transhipment-reporting-secretariat.

WCPFC (2019b). Annual Report to the Commission Part 1: Information on Fisheries, Research, and Statistics—China (WCPFC-SC-15-AR/CCM-03 Rev01). Available at: https://www.wcpfc.int/node/42713.

WCPFC (2019c). Annual Report to the Commission Part 1: Information on Fisheries, Research, and Statistics—Chinese Taipei (WCPFC-SC-15-AR/CCM-23 Rev01). Available at: https://www.wcpfc.int/node/42733.

WCPFC (2019d). Annual Report to the Commission Part 1: Information on Fisheries, Research, and Statistics—Japan (WCPFC-SC-15-AR/CCM-10). Available at: https://www.wcpfc.int/node/42720.

WCPFC (2019e). Annual Report to the Commission Part 1: Information on Fisheries, Research, and Statistics—Liberia (WCPFC-SC-15-AR/CNM-32 Rev01). Available at: https://www.wcpfc.int/node/42710.

WCPFC (2019f). Annual Report to the Commission Part 1: Information on Fisheries, Research, and Statistics—Panama (WCPFC-SC-15-AR/CNM-34). Available at: https://www.wcpfc.int/node/42742.

WCPFC (2019g). Annual Report to the Commission Part 1: Information on Fisheries, Research, and Statistics—Republic of Korea (WCPFC-SC-15-AR/CCM-12). Available at: https://www.wcpfc.int/node/42722.

WCPFC (2019h). Annual Report to the Commission Part 1: Information on Fisheries, Research, and Statistics—Vanuatu (WCPFC-SC-15-AR/CCM-28 Rev02). Available at: https://www.wcpfc.int/node/42738.

Annex 1. Detailed Methodology

AIS-based data methods

Carrier vessels registered at or above 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 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).

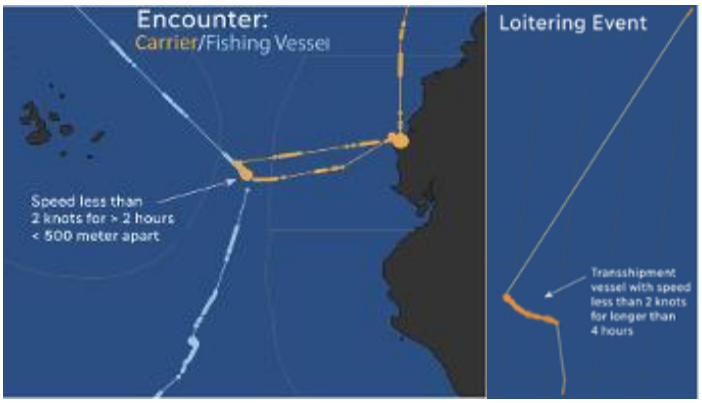

Figure A1 - Examples of vessel tracks during typical 'Encounter' where two vessels meet at sea and 'Loitering' events where a carrier vessel (referred to as transshipment vessel) has behavior consistent with encountering an LSTLFV at sea but no LSTLFV is visible on AIS

The GFW database also contains an estimate of port visits conducted by carrier vessels. 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 (ITU) 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 <= 24 hours in duration, due to a finding from the 2017 transshipment reports (for example see section 4.6 in the 2017 ICCAT report) 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).

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. The WCPFC Convention Area has relatively strong Class-A AIS reception, however, there may be a limit on AIS data in the WCPFC Convention Area due to use of AIS (see Kroodsma et al. 2018, and Taconet, Kroodsma, and Fernandes 2019). For instance, there tends to be less vessel presence in the Southern Ocean (see Kroodsma et al. 2018, and Taconet, Kroodsma, and Fernandes 2019). AIS data tends to be sparser and more limited for vessels equipped with a Class-B AIS device (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 accurate 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).