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A COMPARATIVE ANALYSIS OF AIS DATA WITH THE WESTERN AND CENTRAL PACIFIC FISHERIES COMMISSION REPORTED TRANSSHIPMENT ACTIVITY IN 2019

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Submitted by Pew Charitable Trusts

Global Fishing Watch

A Comparative Analysis of AIS Data with the Western and Central Pacific Fisheries Commission Reported Transshipment Activity in 2019

2019 AIS-Detected Transshipment Activity in Tuna Regional Fisheries 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 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 also launched the Carrier Vessel Portal (CVP) in 2020. 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.

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. This could be because a second vessel is not present or a second vessel is present but no AIS signal has been detected, 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.

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, Francisco Blaha, and Claire van der Geest for reviewing this study.

Prepared by: Global Fishing Watch

Contents

List of Acronyms

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

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) for the Regulation on Transshipment, CMM 2009-06. This CMM includes reporting requirements for both carrier and longline 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 are authorized by WCPFC and must carry a WCPFC observer at all times. The CMM also 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*".

In the previous two years, GFW submitted reports to the WCPFC Commission in which commercially available Automatic Identification System (AIS) data was used to analyze the track histories of carrier vessels operating within the Convention Area during the calendar year 2017 and 2018 respectively. This year's 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 for the calendar year of 2019. Overall, AIS analysis suggests that WCPFC appears to have the fewest instances of potentially unauthorized activity by carrier vessels of all five tuna RFMOs in 2019. To build on this, five findings in three key areas were identified where further improvement might be considered.

Reported Activity

There were numerous discrepancies in the number of reported transshipments in different tables in the WCPFC 2020 Annual Report for the calendar year of 2019, and also discrepancies between the Annual Report and transshipments reported in individual country reports. Discrepancies between Annual Report and country reports were also identified during the transshipment analysis covering the calendar year of 2018. This lack of consistency undermines efforts to monitor compliance of transshipment at sea effectively and efficiently, and complicates attempts to validate reported information against observed data from sources such as VMS and AIS. *Recommendation: Improve reporting requirements to require data be submitted in a more standardized way at minimum of an annual time scale to ensure consistency across all annual reports.*

While there is a requirement for 100% observer coverage on WCPFC carriers, there is no training or certification program for carrier observers, no requirements on the minimum standard data fields, and no requirement on where observer data be submitted. The absence of a data collection framework, minimum standards on data collection, and no expectation on where to submit data increases the risk of illicit activity not being detected and hinders efforts to cross-verify reported transshipments with other monitoring tools, such as AIS data. *Recommendation: Establish guidelines for minimum standard data fields to be collected and require that data from*

carrier observers be submitted to the Secretariat to provide the opportunity for independent cross verification of transshipment declarations where possible. Continue efforts to operationalize a carrier observer training and certification program. Once established, implement a required protocol for ROP to submit standard deployment specific data, including date, time, and geolocation to the commission, and then publish the deployment data publicly to enable cross-verification.

At-Sea Activity

The summary transshipment counts in the WCPFC annual transshipment report and the Member reports indicate that there is frequent cross-over between transshipment activity in WCPFC and IATTC. This is supported in the GFW Carrier Vessel Portal, which shows numerous examples of crossover in likely fishing and transshipment activity between both RFMOs and the overlap, complicating to which RFMO transshipments should be reported. While the MoU between WCPFC and IATTC calls for "*development of processes to promote harmonization and compatibility of conservation and management measures, including measures relating to monitoring, control and surveillance"* there is no training in place to support the cross certification of transshipment observers at this time. *Recommendation: Develop and enact standard training for carrier observers that would enable cross certifying of carrier observers between WCPFC and IATTC to support oversight and information sharing of transshipment activity in the overlap area.*

GFW detected possible transshipment activity of longline encounters inside EEZs and purse seine encounters inside EEZs and on the high seas that may warrant further investigation to ensure compliance. Per, the WCPFC Conservation and Management Measure (CMM) 2009-06 *Regulation on Transshipment,* transshipment with longline vessels "*in national waters shall be managed in accordance with relevant domestic laws…*". Purse seine vessels are prohibited from transshipping with carrier vessels at sea per CMM 2009-06, unless these vessels receive an exemption from the Commission. Although this activity was likely conducted in compliance with Commission regulations, there is a small risk that these encounters were conducted outside the scope of the CMM 2009-06. The AIS analysis offers an opportunity to cross check. *Recommendation: These encounters, detected on AIS, should be checked by relevant management officials.*

Port Activity

Finally, WCPFC's CMM 2017-02 on *Minimum Standards for Port State Measures* is opt-in only, meaning members do not have to participate in the CMM if they choose not to designate a port for landing. Therefore, the minimum requirements for port State controls varies across 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, and thus potentially not all carriers were held to the same control standards or reporting requirements when entering port after an encounter. *Recommendation: WCPFC should review CMM 2017-02 to require the designation of ports visited by foreign-flagged vessels while*

encouraging implementation of stronger port State measures across all Member States, including by designation of ports for application of CMM 2017-02, and CMMs requesting inspections of suspicious vessels in foreign ports.

Activity Overview

Reported activity

The WCPFC 2020 Annual Report indicates either 1353 or 1356 or 1472 reported transshipments occurred in 2019 which were conducted by 66 or 26 carrier vessels and 486 or 503 fishing vessels, depending on which table[1] is being referenced. There were also discrepancies between member country reports and the reported figures in the Annual Report (See Table 1). While WCPFC provides a template for members to provide transshipment data, not all countries fill out tables in the same way. For example, Panama reports 399 transshipments 'Transshipped inside/outside the Convention Area'[2] but it is unclear if the transshipments are from both inside/outside the Convention Area or just inside the Convention Area or just outside the Convention Area. Further, WCPFC refines these numbers over time. For example, the number of reported transshipments for the year of 2018 increased by 2.7%, from 1409 recorded in the 2019 Annual Report up to 1447 in the 2020 Annual Report. While it is encouraging that the numbers are updated to reflect the best information available, shifts in reported transshipments over a year later makes cross verification of reported data difficult.

Similarly, the discrepancies in the number of reported transshipments within the WCPFC 2019 Annual Report, paired with the absence of information clarifying any reasons for the differences in reported values, lead to confusion on which reported figures to use and undermines efforts to compare reported data to AIS detected transshipment activity.

Despite these flaws, the WCPFC 2020 Annual Report remains the primary available source of reported data. We have therefore opted to use transshipment information from tables 3a and 3b of the report to compare to GFW detected activity for the calendar year of 2019.

[1] see table 1 (1472 reported transshipments, 26 carriers, 503 fishing vessels), table 2 (1353 or 1356 reported transshipments, 66 carriers, 486 fishing vessels), and table 3 (1472 reported transshipments) in the 2020 Annual Report

[2] See Annex II (b) on page 7 https://meetings.wcpfc.int/node/11627

Table 1. Comparison of WCPFC transshipment activity in 2019 from 2020 Annual Report and transshipment data from Flag State CCM Annual Reports

CMM Country	Table 2 annual report[3]				Table 3 annual report[4]		Member country reports[5]	
	Count of vessels in reports received		Count of reported transhipment events		Count of vessels in reports received		Count of reported transhipment events	
	As receiving vessels	As offloading vessels	Receiving vessel	Offloading vessel	Receiving vessel	Offloading vessel	Receiving vessel	Offloading vessel
China	2	137	120	293	153	356	80	243
Japan		3		3		6		
Republic of Korea	7	71	187	113	201	125	186	113
Liberia	3		146		154		147	147
Panama	8		380		427		399	
Chinese Taipei	45	233	489	825	498	855	500	831
Vanuatu	1	42	31	122	39	130	57	190
TOTAL	**66**	**486**	**1353**	**1356**	**1472**	**1472**	**1369**	**1524**

To improve reporting requirements and ensure consistency across all annual reports, WCPFC should require reported transshipment data be submitted in a standard format. Additionally, a more timely submission deadline will resolve difficulties in cross validation.

High seas overview - longline vessels

Using AIS, GFW identified 662 encounters between carriers and longline vessels on the high seas south of 32 degrees north[6] in the WCPFC Convention Area in 2019. These encounters involved 27 carriers and 334 drifting longlines. Additionally, a total of 91 carriers were observed undertaking 510 loitering events in the Convention Area which were unmatched[7] to encounters

[3] https://www.wcpfc.int/doc/wcpfc-tcc16-2020-rp03rev1/annual-report-wcpfc-transhipment-reporting-rev-1
[4] https://www.wcpfc.int/doc/wcpfc-tcc16-2020-rp03rev1/annual-report-wcpfc-transhipment-reporting-rev-1
[5] For individual country reports, see https://meetings.wcpfc.int/meetings/sc16-2020
[6] Analysis of detected loitering events was limited to high seas events, south of 32 degrees North latitude as in the previous years' report. The geographic bound was set by the latitudinal range of longline vessel detected encounters in 2019 to remove loitering events for the WCPFC analysis more likely to be related to transshipment of NPFC managed species.
[7] Due to the definition of encounter and loitering, 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 1). All carriers detected in longline encounters and loitering events appeared to be authorized by both WCPFC and IATTC.

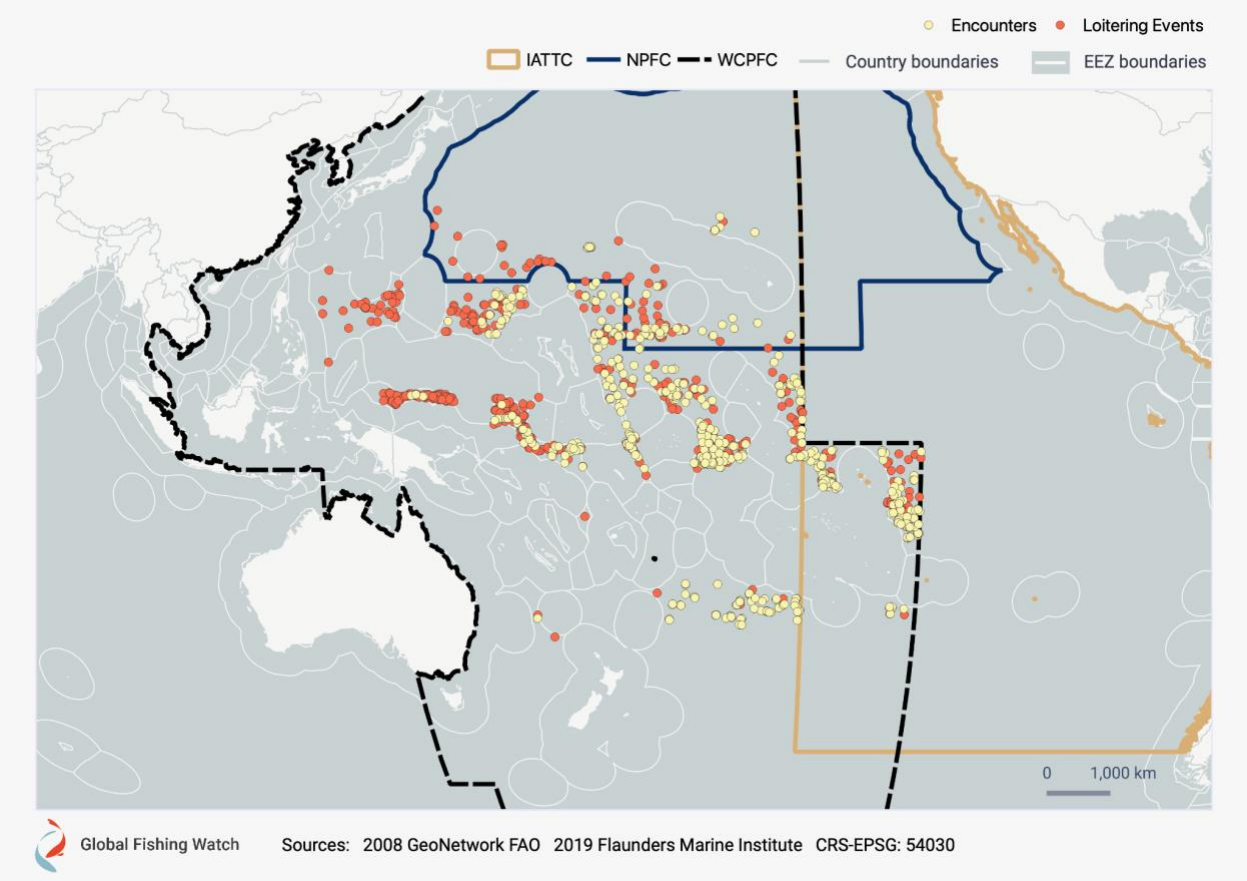

Figure 1. Possible high seas transshipment activity related to longlines conducted by carriers in the WCPFC

Of the 1,172 potential transshipment events detected on AIS in the area of interest, 224 events were detected in the WCPFC-IATTC overlap. Overall there was a 4.3% increase in AIS-detected transshipment events in the WCPFC Convention Area as compared to 2018[8]. WCPFC is the only tuna RFMO with an increase in detected transshipment on AIS in 2019 as compared to 2018[9]. WCPFC also reported the most at-sea transshipments of the tuna RFMOs, with 38.6%[10] of reported at-sea transshipments in 2019.

[8] 1,124 potential transshipments were detected on AIS in 2018. https://globalfishingwatch.org/wp-content/uploads/WCPFC_2018.pdf

[9] Referenced RFMO reports, once published, will be available at https://globalfishingwatch.org/rfmo-transshipment/

[10] A total of 3816 at sea transshipments were reported across the five tuna RFMOs in 2019. WCPFC reported 1472 transshipments while ICCAT reported 434, IATTC reported 593, and IOTC reported 1317 transshipments. CCSBT reported 66 SBT transshipments which are captured in the IATTC and ICCAT ROP reported transshipments.

Activity by flag state

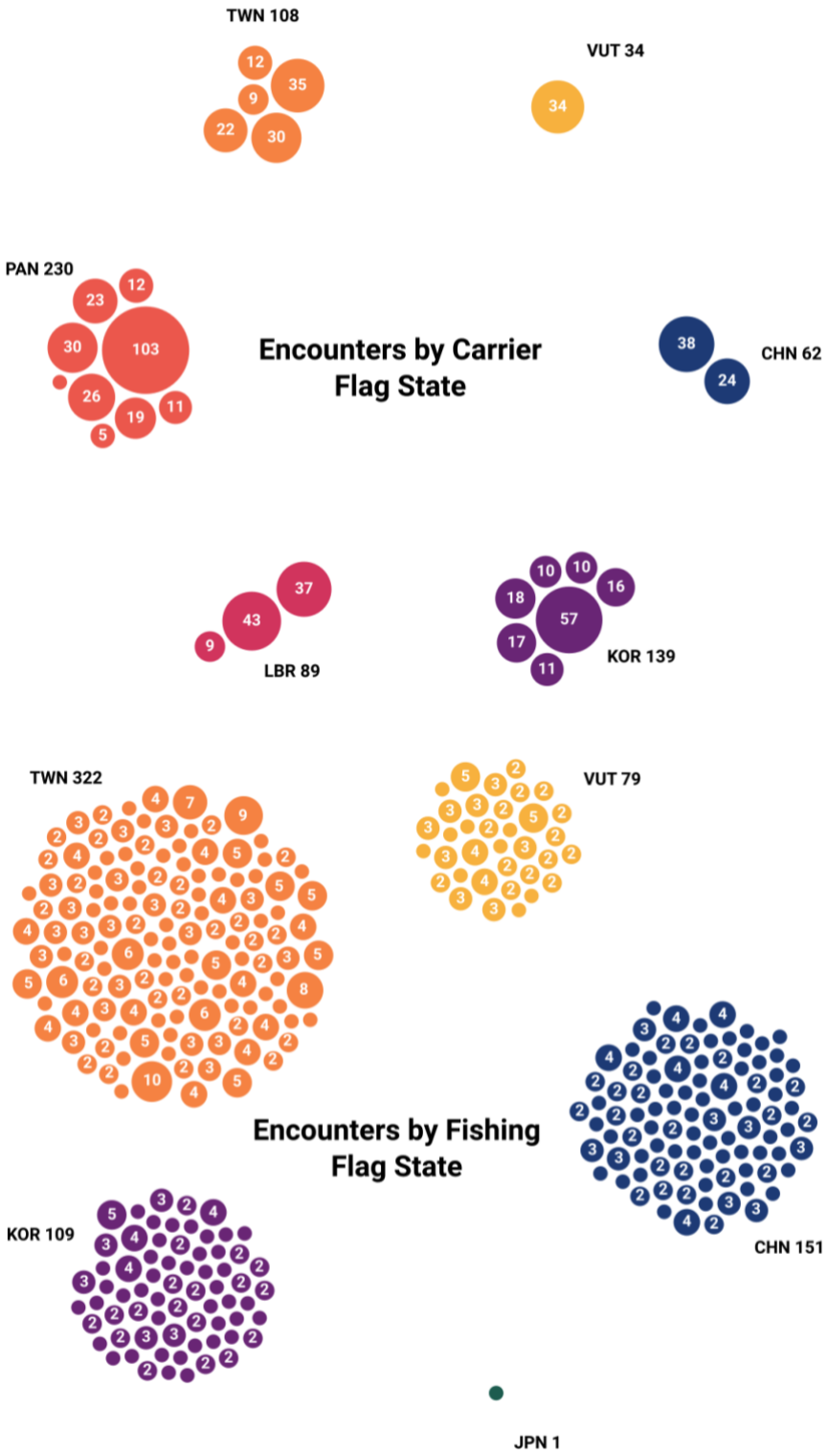

Figure 2A. GFW-detected encounter events by carrier flag State and **2B.** Fishing vessel flag State. Note: bubbles indicate unique carriers or fishing vessels

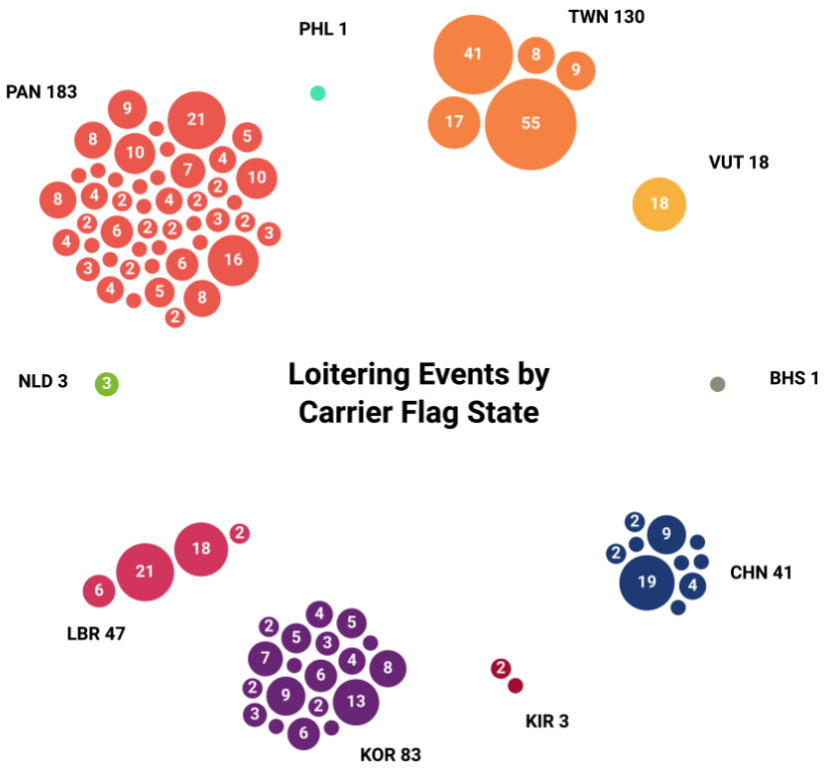

Figure 3. GFW-detected loitering events by carrier flag State. Note: bubbles indicate unique carriers

By flag State, carriers flagged to Panama, Korea, and Chinese Taipei were detected in the greatest number of encounters and of loitering events (Figure 2A; Figure 3). Longline vessels flagged to Chinese Taipei, China, and Korea were detected in the greatest number of encounters (Figure 2B). These trends are consistent with what was observed in 2018. The only new flag State activity on AIS involved one Filipino flagged carrier which was detected on AIS in a single loitering event (Figure 3). All fishing vessels detected in encounters were flagged to States which were detected in potential transshipment events on AIS in 2018.

Reported versus observed activity

GFW compared the AIS detected encounters and loitering events against the WCPFC Annual Report's reported transshipments[11] (Figure 4). Transshipment activity on the high seas in the WCPFC Convention Area remained steady both in terms of reported and AIS-detected transshipments between 2018 and 2019 with a 1.7% increase in reported transshipments (1447 in 2018 and 1472 in 2019), and a 4.3% increase in AIS-detected transshipments (1124 in 2018 and 1172 in 2019). From this we see AIS captured the same trends in reported activity between

[11] The Annual Report included conflicting information on the number of reported transshipments by State (see Table 1). Table 3b from the 2020 Annual Report is used for comparison to AIS detected transshipment activity.

years and across member States, and consequently acts as a useful tool for not only monitoring individual vessel activity, but to conduct large scale pattern analysis efficiently over time.

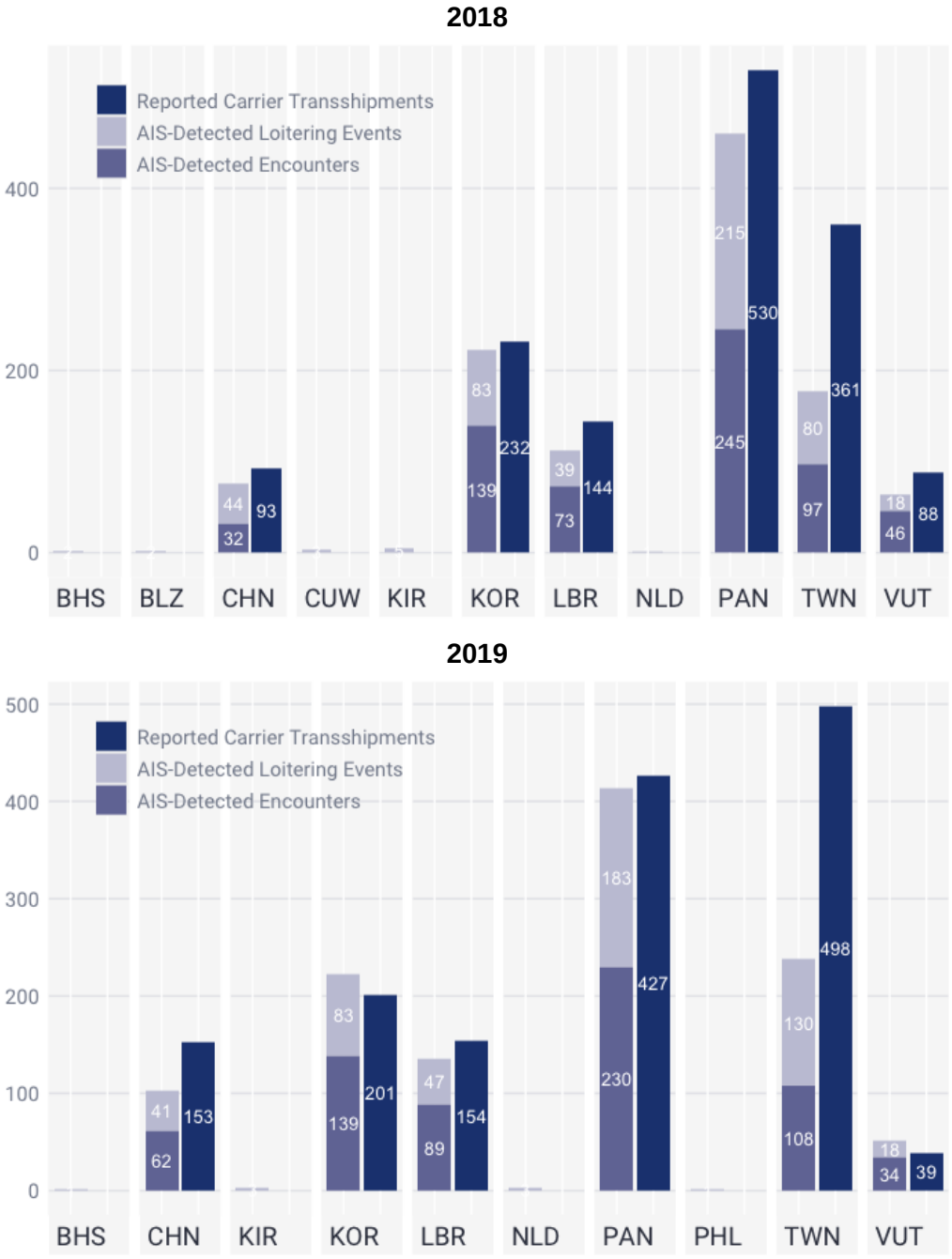

Figure 4. Comparison of WCPFC Reported and AIS detected high seas transshipment activity for 2018 and 2019[12]

[12] Reported values in Figure 4 come from table 3b of 2020 Annual Report for 2018 and 2019.

The number of reported transshipments by Panama, Liberia and Korea all appeared close[13] to the number of AIS detected potential transshipments. There was more variation between reported transshipments by China, Chinese Taipei and Vanuatu and the counts of their AIS detected activity (Figure 4).

Chinese Taipei was the flag State with the largest difference between the number of reported and the number of AIS-detected transshipments (109% more reported transshipments than detected by AIS), followed by carriers flagged to China (47.1% more reported transshipments). Both countries reported more transshipment activity than was detected on AIS. Vanuatu in contrast was observed in more AIS detected potential transshipment activity than was reported (33.3% more AIS detected transshipments) (Figure 4). High reported numbers of transshipments as compared to the AIS detected events may indicate a portion of events occurred where either the fishing vessel or carrier were not transmitting on AIS, which may be due to poor reception quality, AIS device class, or lack of transmission (see Annex 1 for more information on AIS Data caveats).

While count of reported transshipments differed from detected activity, fleets were consistent in change over time regardless of data source (Figure 4). For example, between 2018 and 2019 Chinese carriers were detected in twice as many encounters while loitering events were about the same resulting in a 36.8% increase in AIS detected activity. Reported figures[14] from the Annual Report indicated a 64.5% increase in Chinese carrier activity over the same time span. There was also a 34.5% increase in AIS-detected transshipment activity by Chinese Taipei carriers, compared to a 38% increase in reported transshipments. There was a 10.2% decrease in AIS-detected transshipment activity by Panamanian carriers as compared to a 19.4% decrease in reported activity.

These observed shifts in fleet activity between 2018 and 2019 may be the result of shifting fishing and transshipment efforts by the flag States, but also could be a result of a shift in fleet usage (e.g., Chinese Taipei fleet is using Chinese Taipei carriers more often rather than Panamanian carriers) and not necessarily due to an increase in fishing effort and/or transshipment activity. The Annual Report indicates that some activity outside the Convention Area is included in the Annual Report. However, while it is possible to detect encounters outside the Convention Area using AIS, it is not feasible to identify those events which occurred with a WCPFC observer on board. It is therefore difficult to quantify the impact of the absence of such encounters in our analysis.

Despite this, AIS analysis accurately tracked the proportional shift in likely transshipment activity across years, consistent with the Annual Report, illustrating how AIS can be used as a supplemental tool to VMS to verify reported trends.

[13] Reported and AIS detected transshipment activity being within 15% difference. Panama (3.4% more reported transshipments), Liberia (13.2% more reported transshipments), Korea (10.4% more AIS transshipments).
[14] See table 3b here: https://www.wcpfc.int/doc/wcpfc-tcc16-2020-rp03rev1/annual-report-wcpfc-transhipment-reporting-rev-1

To improve AIS data comparisons to reported transshipment data, the WCPFC should develop a carrier observer training and certification program with requirements on minimum standard data fields as well as a framework for reporting carrier observer data to the Secretariat to be provided in the annual Commission reports.

WCPFC-IATTC overlap

The amount of transshipment activity detected in the WCPFC-IATTC overlap was consistent between 2018 and 2019. There were 224 potential transshipment events detected in the WCPFC-IATTC overlap in 2019 compared to 226 potential transshipment events detected in the overlap in 2018[15]. From IATTC deployment data it is known that carrier trips observed under the IATTC ROP frequently include activity in WCPFC. In GFW's Carrier Vessel Portal (CVP) there are examples of likely fishing and transshipment activity between both RFMOs and in the overlap (like this example here). However, the WCPFC ROP does not have an observer program for carrier vessels and thus there is no ROP deployment level data, so it is not possible to verify which transshipments in the overlap were reported to WCPFC, or both RFMO's.

Therefore, similar to the 2019 IATTC Transshipment Report, it is recommended that:

- To improve oversight of transshipments in the overlap area, WCPFC should work on a standardized training program for observers aboard WCPFC carrier vessels
- Once established, WCPFC should work with IATTC to cross certify carrier observers across both RFMOs
- Both WCPFC and IATTC should make their ROP data publicly available, including information on authorized vessel deployments, dates and locations of observed transshipments, and information on the species transferred during transshipment events.

For in-depth analysis of transshipment and fishing activity in the WCPFC-IATTC overlap area, see the 2019 IATTC Transshipment Report.[16]

[15] Reference pages 10 and 12 of WCPFC 2018 Transshipment report at https://globalfishingwatch.org/wp-content/uploads/WCPFC_2018.pdf

[16] Referenced RFMO reports, once published, will be available at https://globalfishingwatch.org/rfmo-transshipment/

Fishing Activity Outside of WCPFC Policy

Longline encounters in EEZs

GFW detected possible transshipment activity between carriers and longline vessels inside EEZs. The CMM 2009-06 states that *"...Transhipment from longline, troll and pole and line fishing vessels in national waters shall be managed in accordance with relevant domestic laws and procedures pursuant to paragraph 4."* Therefore, this detected activity may likely be in compliance with national laws, however, as details on any authorizations at that level are known it is valuable to highlight activity detected by AIS that may aid in any further investigation of compliance.

There were two carriers detected encountering longline vessels in the EEZs of Pacific Island States in the WCPFC Convention Area (Figure 5).

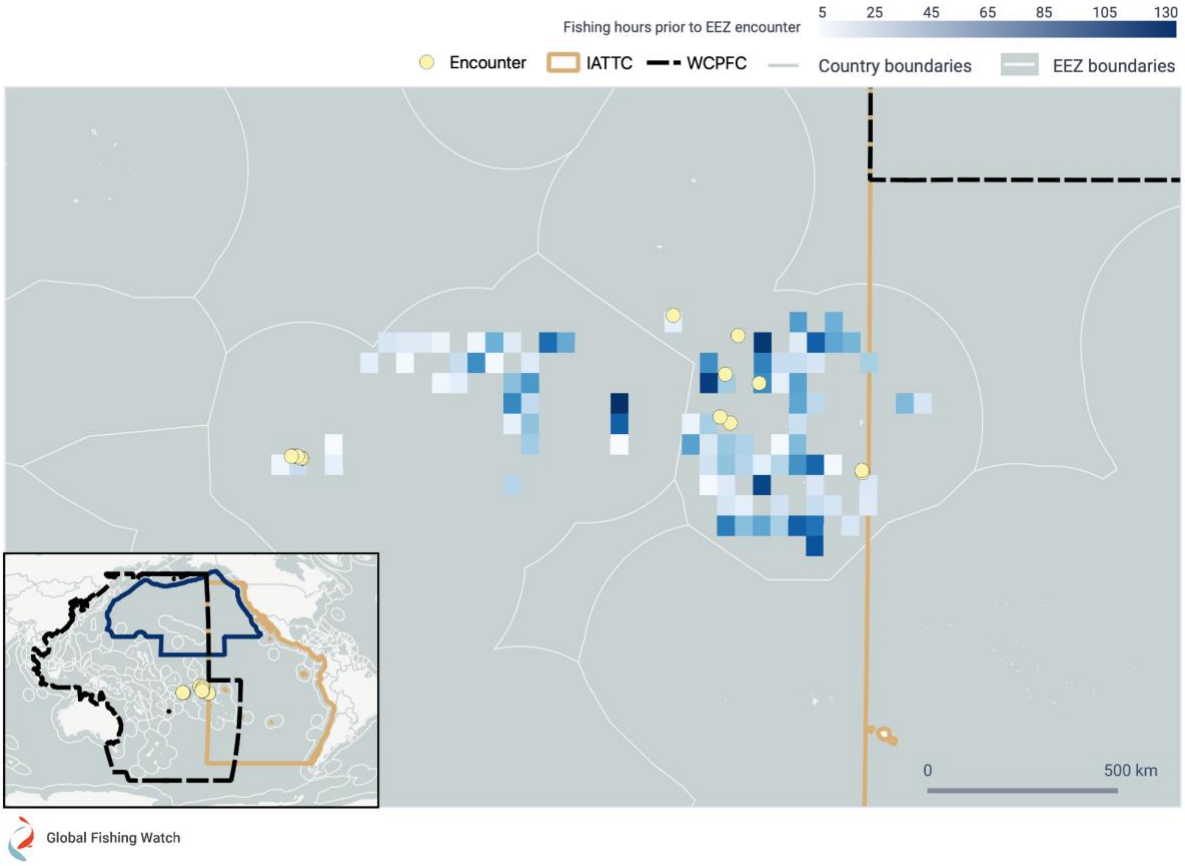

Figure 5. Longline encounters in EEZ's with fishing effort prior to encounters.

Eight detected encounters occurred between a Panamanian flagged carrier and eight different longline vessels flagged to China in the EEZ of Kiribati during a single carrier trip which concluded in Papeete, French Polynesia. Both the carrier and longline vessels detected in these encounters were authorized to WCPFC and IATTC and the activity occurred during an IATTC authorized deployment. Given both the carrier and the longline vessels involved in the encounters were authorized, there was an IATTC observer on board, and the port visited after the detected encounters was to Papeete, a port which opted-in to WCPFC's Port State Measure and thus is subject to minimum port inspection schemes, this activity is considered low risk. However, information on observer deployments and authorized/reported events from the WCPFC ROP would help stakeholders to verify and cross check information. GFW can provide more information if any parties wish to follow up in regards to ensuring compliance with the PNA Implementing Arrangements and vessel reporting.

There were also seven detected encounters between a Chinese carrier and six different Chinese flagged longline vessels in the EEZ of the Cook Islands during a single carrier trip which concluded in Avatiu, Cook Islands. Both the carrier and longline vessels detected in these encounters were authorized to WCPFC and IATTC and the activity occurred during an IATTC authorized deployment. Further the longline vessel at-sea transshipment can be authorized by Cook Islands while also monitored by the Pacific Islands Forum Fisheries Agency (FFA). Subsequently while the risk is low the activity was not authorized or cross checked, it is of note that the Chinese carrier involved in the detected encounters has previously been investigated for potential unauthorized activity related to the transshipment of Southern Bluefin Tuna (SBT)[17]. The Secretariat as well as the Member States with detected potential transshipment activity in their EEZs may wish to investigate further to confirm if unauthorized transshipment activity occurred.

Purse seine encounters

As with the 2018 analysis, GFW detected encounters between carriers and purse seine vessels in the EEZs of Pacific Island States and on the adjacent high seas.

[17] https://www.ccsbt.org/en/system/files/CC14_10_PotentialNon-MemberFishingActivityandTrade.pdf

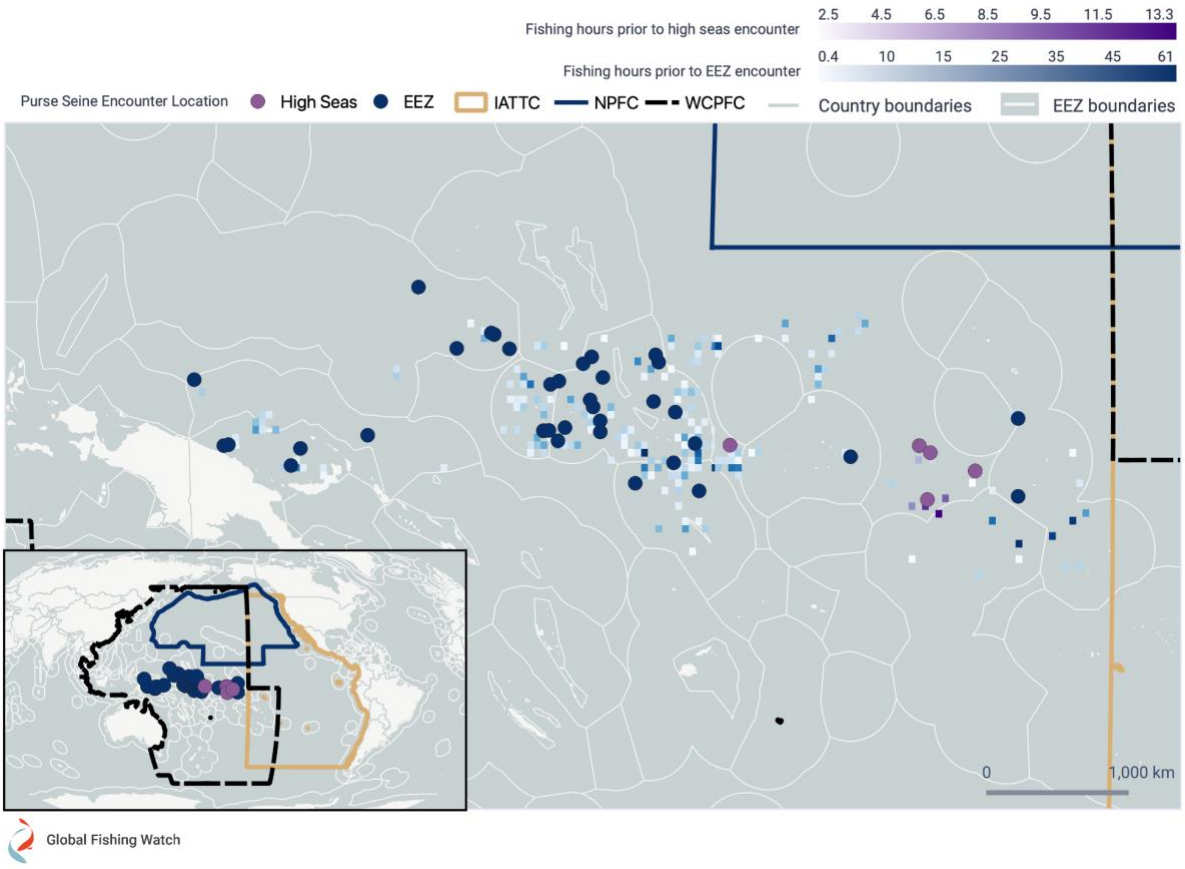

Figure 6. Purse seine fishing activity as a gradient of effort (light to dark) prior to AIS-detected encounters (shown as points) with a carrier vessel. Blue indicates activity related EEZ encounters, and purple indicates activity related to high seas encounters.

There were 39 encounters between carriers and purse seine fishing vessels which were detected within EEZs of Pacific Island States, and five encounters which occurred on the adjacent high seas (Figure 6). Detected EEZ encounters lasted between two to 16 hours, while high seas encounters were detected to be between two and a half to four and a half hours in duration. This activity could warrant further investigation given CMM 2009-06 states "*...transhipment at sea by purse seine vessels shall be prohibited except in respect of exemptions granted by the Commission…*" and 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*".

While it is possible that detected encounters are not related to the transfer of WCPFC-managed catch, especially on the high seas where fishing prior to encounters appears low, 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[18]. 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

In 2019, AIS data indicated twelve port States were visited by carriers after encounters with longline vessels in the WCPFC Convention Area. All ports visited after encounters were to Member States or Participating Territories. The four most frequented ports were the same as in 2018 with Kaohsiung, Chinese Taipei (34.8% of visits after encounters) being the most visited port followed by Majuro, Marshall Islands (11.6%), Busan, Republic of Korea (11.6%), and Papeete, French Polynesia (11.6%) (Figure 7).

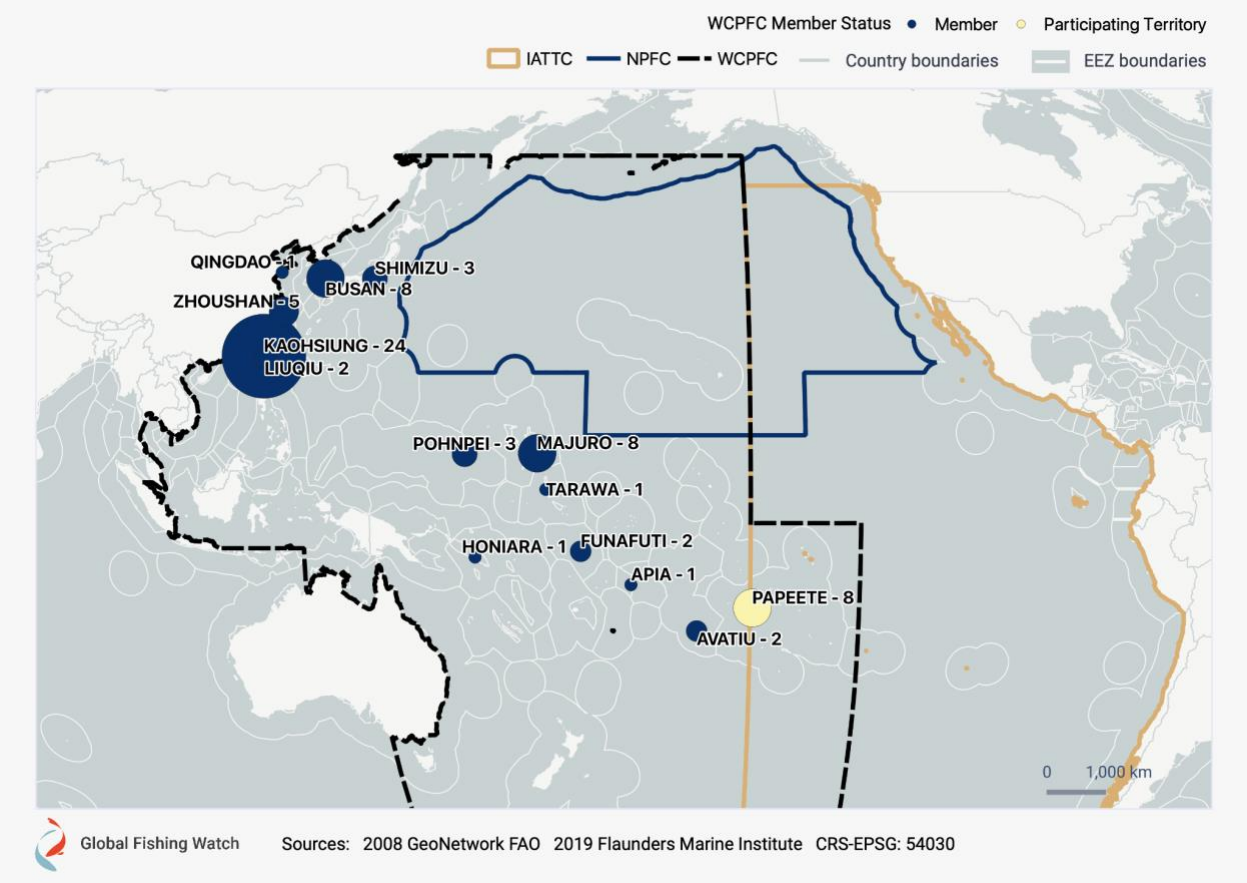

Figure 7. Count of port visits by carriers after AIS-detected encounter events within the WCPFC

[18] 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

Carriers flagged to Chinese Taipei showed a preference for frequenting domestic ports, while carriers flagged to Panama and Korea visited the greatest diversity of port States after encounters, visiting ports in seven different States each (Figure 8).

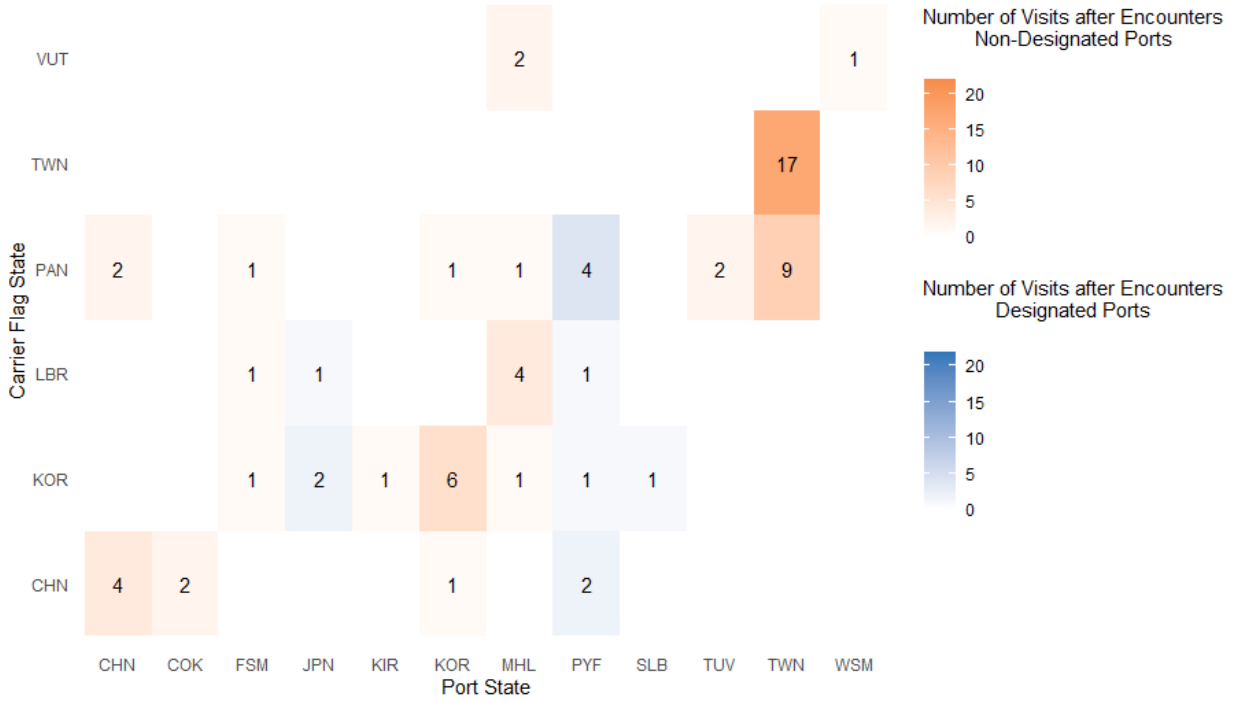

Figure 8. Number of port visits by carrier flag state and port state after detected encounters. Blue visits indicate port visits to States which opted-in to WCPFC's Port State Measures (PSM). Orange visits indicate port visits to States which did not opt-in to WCPFC's PSM.

It is recognized that regionally there are initiatives in place to improve port State measures, including the FFA Regional Port State Measures Framework, but this report is looking solely at the provisions of CMM 2017-02. While it is promising carriers are seemingly landing at Member ports, CMM 2017-02 is an opt-in measure, and Members are therefore not required to implement any controls or carry out inspections, should they choose not to designate any ports.

Three ports, comprising twelve port visits, or 17.4% of port visits after encounters, were designated for entry by WCPFC's Port State Measure (Figure 8). These ports were Shimizu, Japan, Honiara, Solomon Islands, and Papeete, French Polynesia. The other 57 visits were to eleven ports in nine States. A large proportion of these visits were to Asian ports (40 port visits to ports in Chinese Taipei, China, and Korea). The remaining 17 visits were to ports in Small Island Developing States which are all members to the FFA. It is important to note carrier flag States are also responsible for ensuring their vessels enter PSMA designated ports, and therefore WCPFC Member States with carrier fleets should ensure fleets use designated ports. For further information on port visits after encounters, see Annex 2.

China and Chinese Taipei have not opted-in to WCPFC's Minimum Port State Measure nor are they party to the PSMA. With the exception of China's Membership to ICCAT, whose PSM applies to Member CPCs regardless of if transshipments fall in the Convention Area, neither China nor Chinese Taipei are party to any agreement with guiding measures for minimum port inspections. Korea is party to the PSMA, however Busan is not designated for entry under the agreement. Samoa is party to the PSMA, in addition to being an FFA member, however Apia is not a PSMA Designated Port for Entry either. Thus, none of the ports visited after encounters in the WCPFC Convention Area, other than visits to WCPFC Member States and Participating Territories which opted in to CMM 2017-02, were required to implement any controls or carry out inspections. Additionally, WCPFC CCMs cannot request inspections be carried out on suspicious vessels in these ports that have not been designated. The FFA provides guidelines to members on minimum port inspections under its Regional Port State Measures Framework[19], but these are not binding requirements. As FFA members advance in their implementation of the framework, they should designate their ports under WCPFC's CMM, and advocate for better alignment at regional level.

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 2019, there is risk for potentially non-compliant behavior at-sea and in EEZs that should be of concern to the Commission. 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 a dually-managed area 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 a variety of port inspection schemes or none at all.

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

[19] https://www.ffa.int/node/2454

Finding	Recommendation for WCPFC
Differences in reported number of transshipments conducted by Member States' annual reports and vessel reporting as compiled in the WCPFC Annual Report on Transhipment. A lack of publicly available ROP reported transshipment data by deployment to cross-verify AIS data	Improve reporting requirements to require data be submitted in a more standardized way at minimum of an annual time scale to ensure consistency across all annual reports. Establish carrier observer ROP and implement a required protocol for ROP to submit standard deployment specific data, including date, time, and geolocation to the commission, and then publish the deployment data publicly to enable cross-verification. Use supplemental data such as AIS, in conjunction with VMS data, to validate reported information and fill in information gaps where necessary.
Continued frequent cross-over between transshipment activity in WCPFC and IATTC as detected on AIS and reported by WCPFC AIS-detected encounters between carrier vessels and purse seine vessels in coastal States' EEZs and on the high seas after the purse seine vessels appeared to have fished. AIS-detected encounters between carrier vessels and longline vessels in coastal States' EEZs after longline vessels appeared to have fished.	Develop and enact standard training for carrier observers that would enable cross certifying of carrier observers between WCPFC and IATTC. Member States that had AIS detected encounters inside their EEZs may consider investigating this activity to ensure instances of non-compliance did not occur. WCPFC may verify encounters on the high seas with the carrier flag States. Carrier flag States in collaboration with the Secretariat could investigate activity by their vessels identified on AIS as potentially transshipping with longline vessels in EEZs
AIS data indicated only 17.4% of visits by carriers visited to ports after encounters with longline vessels were to ports which opted-in to WCPFC's CMM 2017-02 on Minimum Standards for Port State Measures.	WCPFC should review CMM 2017-02 to require the designation of ports visited by foreign-flagged vessels while encouraging implementation of stronger port State measures across all Member States, including by designation of ports for application of CMM 2017-02, and CMMs requesting inspections of suspicious vessels in foreign ports.

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Annex 1. Detailed Methodology

AIS-based data methods

Carrier vessels 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 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 2019 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. While datasets used in this report match the CVP, this analysis added a number of additional constraints to the potential transshipment events analyzed (geographic area of interest, minimum and maximum restrictions on loitering events) and thus the CVP data must be filtered to match these constraints.

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).

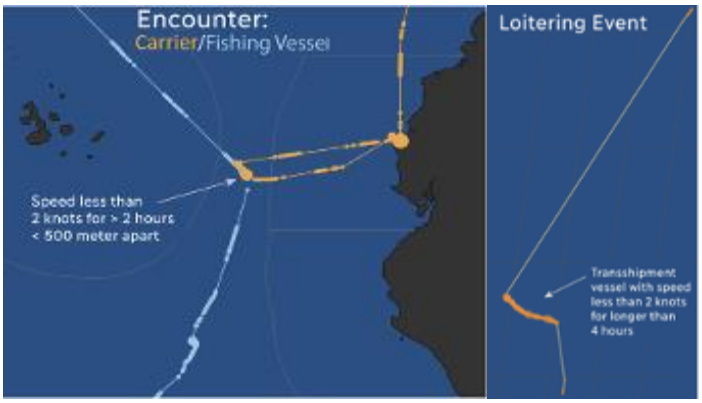

Figure A1 - Examples of vessel tracks during typical 'Encounter' where two vessels meet at sea and 'Loitering' events where a carrier vessel (referred to as transshipment vessel) has behavior consistent with encountering an LSTLFV at sea but no LSTLFV is visible on AIS

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 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. 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 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).

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, Kroosdma, and Fernandes 2019). For instance, there tends to be less vessel presence in the Southern Ocean (see Kroodsma et al. 2018, and Taconet, Kroosdma, and Fernandes 2019). AIS data tends to be sparser and more limited for vessels equipped with a Class-B AIS device (Kroodsma et al. 2018 and Taconet, Kroosdma, 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).

Annex 2. Designation Information on Ports Visited After Encounters

Port State	Port	PSMA [20]	PSMA DPE[21]	WCPFC[22]	PSM opt-in[23]	WCPFC DPE[24]	Carrier Visits	Encounters
TWN	KAOHSIUNG	NO	NO	Member	NO	NO	24	269
KOR	BUSAN	YES	NO	Member	NO	NO	8	88
MHL*	MAJURO	NO	NO	Member	NO	NO	8	87
PYF	PAPEETE	YES	NO	Participating Territory	YES	YES	8	54
CHN	ZHOUSHAN	NO	NO	Member	NO	NO	5	22
FSM*	POHNPEI	NO	NO	Member	NO	NO	3	38
JPN	SHIMIZU	YES	YES	Member	YES	YES	3	29
COK*	AVATIU	NO	NO	Member	NO	NO	2	30
TUV*	FUNAFUTI	NO	NO	Member	NO	NO	2	12
TWN	LIUQIU	NO	NO	Member	NO	NO	2	7
WSM*	APIA	YES	NO	Member	NO	NO	1	2
SLB*	HONIARA	NO	NO	Member	YES	YES	1	13
CHN	QINGDAO	NO	NO	Member	NO	NO	1	1
KIR*	TARAWA	NO	NO	Member	NO	NO	1	10

* = FFA member

[20] http://www.fao.org/treaties/results/details/en/c/TRE-000003/
[21] http://www.fao.org/fishery/port-state-measures/psmaapp/?locale=en&action=qry
[22] https://www.wcpfc.int/about-wcpfc
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