



Luke Duggleby for The Pew Charitable Trusts

Transshipment in the Western and Central Pacific

Greater understanding and transparency of carrier vessel fleet dynamics would help reform management

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About this report

Information used to inform this study included publicly available data from regional fisheries management organizations, including the Western and Central Pacific Fisheries Commission, the North Pacific Fisheries Commission, the Inter-American Tropical Tuna Commission, the Indian Ocean Tuna Commission, and the International Commission for the Conservation of Atlantic Tunas. Pew researchers cross-referenced information by using the IHS Maritime and Trade Maritime Portal and Vesseltracker.com, a provider of automatic identification system data on vessel movements worldwide and maritime information services, as well as the carrier vessel database produced by Global Fishing Watch and SkyTruth in their August 2017 report, “The Global View of Transshipment: Revised Preliminary Findings.”

External reviewers

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The Pew Charitable Trusts is driven by the power of knowledge to solve today's most challenging problems. Pew applies a rigorous, analytical approach to improve public policy, inform the public, and invigorate civic life.

Overview

The transshipment of catch, which allows fresh fish to get to market sooner, is a vital but largely hidden part of the global commercial fishing industry. Transshipment involves hundreds of refrigerated cargo vessels, or carrier vessels, roaming the oceans, taking in catch from thousands of fishing vessels and transporting it to shore for processing. While transshipment touches a wide range of seafood products, most is made up of bigeye, yellowfin, and skipjack tuna. Salmon, mackerel, and crab also account for a substantial portion of transshipped products.

Moving catch from one vessel to another may seem innocuous, but most transshipments take place far out at sea—where, out of the sight and reach of authorities, unscrupulous fishing vessel operators can obscure, manipulate, or otherwise falsify data on their fishing practices, the species or amounts caught or transferred, and catch locations. Based on extensive data from regional fisheries management organizations (RFMOs), such activity appears to be widespread the world over, reflecting a lack of monitoring and control because the tracking of these transfers—and the degree to which they are conducted in line with regulatory requirements—is often inadequate. Even when transshipment occurs in port, proper oversight cannot always be guaranteed because some ports lack sufficient monitoring capacity, inspection procedures or protocols.

At stake are efforts to improve the health of diminishing fish stocks—and the economies of countries that are heavily dependent on fishing.¹ In the western and central Pacific Ocean, over US\$142 million worth of illegal, unreported, and unregulated (IUU) product is transshipped each year, a 2016 study estimated, most of it misreported or not reported by licensed fishing vessels.² These activities don't just harm the livelihoods of those who fish legally. They also undermine fisheries conservation and management efforts, contribute to global overfishing, and, according to multiple credible reports, have even been linked to trafficking in people, drugs, and weapons.³

The relative lack of transparency surrounding the movement of carrier vessels and their activities has meant that transshipment operations remain poorly monitored at both the regional and global levels. To better understand transshipment operations, The Pew Charitable Trusts combined commercially available satellite automatic identification system (AIS) data with the application of machine learning technology to analyse the movements of carrier vessels operating in the Western and Central Pacific Fisheries Commission (WCPFC) Convention area in 2016.

Incomplete use of AIS by WCPFC-authorized carrier vessels limited Pew's ability to comprehensively examine and draw conclusions about carrier vessel fleet dynamics. But analysing AIS data provided an opportunity to better understand overall WCPFC carrier vessel fleet movement patterns—including spatial dynamics, voyage profiles and the most frequented ports. That data showed that at least 140 carrier vessels operated in WCPFC Convention area waters in 2016, but only 25 vessels reported high seas transshipments.⁴ Per the combined analysis of AIS data and publicly available reports to WCPFC, a strong probability exists that more at-sea transshipment events occurred that year than were reported by carrier vessels themselves or by relevant flag or coastal State authorities. Similarly, unauthorized carrier vessels probably carried out transshipment activities in WCPFC-managed waters that included, in part, transferring WCPFC-managed species.

Pew cross-referenced the AIS track histories of carrier vessels and movement patterns consistent with transshipment behaviour against publicly available information on carrier vessels and transshipments reported by the WCPFC secretariat and Commission members. The analysis produced a baseline profile of the behaviour and trends of authorized carrier vessels in the Pacific. Pew found that transshipment management in WCPFC-managed waters is compromised by a lack of reporting information, non-compliance with reporting requirements, and non-standardized reporting responses. As such, the regulatory framework requires significant strengthening, standardization, and harmonization, regardless of whether current reporting requirements are being met.

Pew recommends that three parts of the transshipment regulatory framework be strengthened: **reporting**, **monitoring** and **data sharing**.

Transshipment reporting would be much more complete and uniform by:

- Requiring that all events be reported, regardless of location or origin of catch.
- Updating and standardizing all reporting and notification forms and including minimum data collection requirements for both target and by-catch species.
- Mandating notifications of intent to transship when carrier vessels enter WCPFC waters, including confirmation of compliance with near-real-time vessel monitoring system (VMS) reporting and observer carriage requirements.
- Requiring electronic notifications and declarations within the 24 hours before and after each event, regardless of location.
- Mandating the presence of observers on all vessels involved in transshipping and requiring submission of observer reports after each event as an independent means of verification.
- Requiring that the secretariat conduct annual audits of transshipment reporting and carrier vessel activities, using both public and non-public domain data.

Transshipment monitoring would be much more effective by:

- Requiring 100 per cent observer coverage (human and/or electronic) on all vessels involved in transshipment, regardless of location.
- Establishing minimum standards for collecting carrier observer information.
- Ensuring that all vessels engaged in transshipment have access to a pool of trained and certified carrier observers who collect information for both scientific and compliance purposes.
- Requiring that all vessels engaged in transshipment have an operational VMS unit on board to help authorities monitor and track vessels port to port in near-real time.
- Mandating manual reporting and vessel monitoring arrangements if VMS units malfunction or fail.
- Considering requiring AIS usage by all WCPFC-authorized vessels as a supplement to VMS to make activities more transparent and improve overall vessel monitoring.

Transshipment data sharing would be much more effective by:

- Establishing and harmonizing transshipment data-sharing procedures among all relevant national authorities and the secretariat.
- Expanding the data-sharing agreement between the WCPFC and the Inter-American Tropical Tuna Commission (IATTC) to include sharing of all transshipment-related data and involving the IATTC's carrier observer service provider.
- Establishing a data-sharing agreement with the North Pacific Fisheries Commission (NPFC) to include sharing all transshipment-related data.

Greater oversight and transparency of transshipment operations would support the growing efforts by responsible governments and seafood suppliers to better track their supply chains. Improved transparency would also help RFMOs detect and deter illegal activities.

While this report aims to give WCPFC fishery managers information to help them implement the Commission's December 2018 decision to review its transshipment management measures this year,⁵ other global RFMOs could also consider the recommendations and best-practice guidelines.

The complex world of transshipment in the WCPFC Convention area

RFMOs are administrative bodies made up of governments that share interests in managing and conserving fish stocks in a region. These include coastal States, whose waters are home to the managed stocks, and "distant water fishing nations," whose fishing fleets travel to areas where those stocks are found. At least 13 RFMOs actively manage fish stocks on the high seas, and some of their areas overlap. Of these, five (including the WCPFC) are tuna RFMOs, which manage fisheries for tuna and other large, tuna-like species such as swordfish and marlin. Together, these five manage fisheries in about 90 per cent of the Earth's oceans.⁶

The WCPFC is the largest tuna RFMO, covering about 20 per cent of the planet's surface. It comprises 26 member governments, seven cooperating non-members and seven participating territories (collectively referred to as CCMs). Decisions are binding on the CCMs and require unanimous consent. Article 1(e) of the WCPFC Convention⁷ defines fishing vessels as "any vessel used or intended for use for the purpose of fishing ... including carrier vessels." Therefore, carrier vessels operating outside the jurisdiction of the nation whose flag they fly in the WCPFC Convention area must be authorized and listed on the WCPFC Record of Fishing Vessels (RFV).

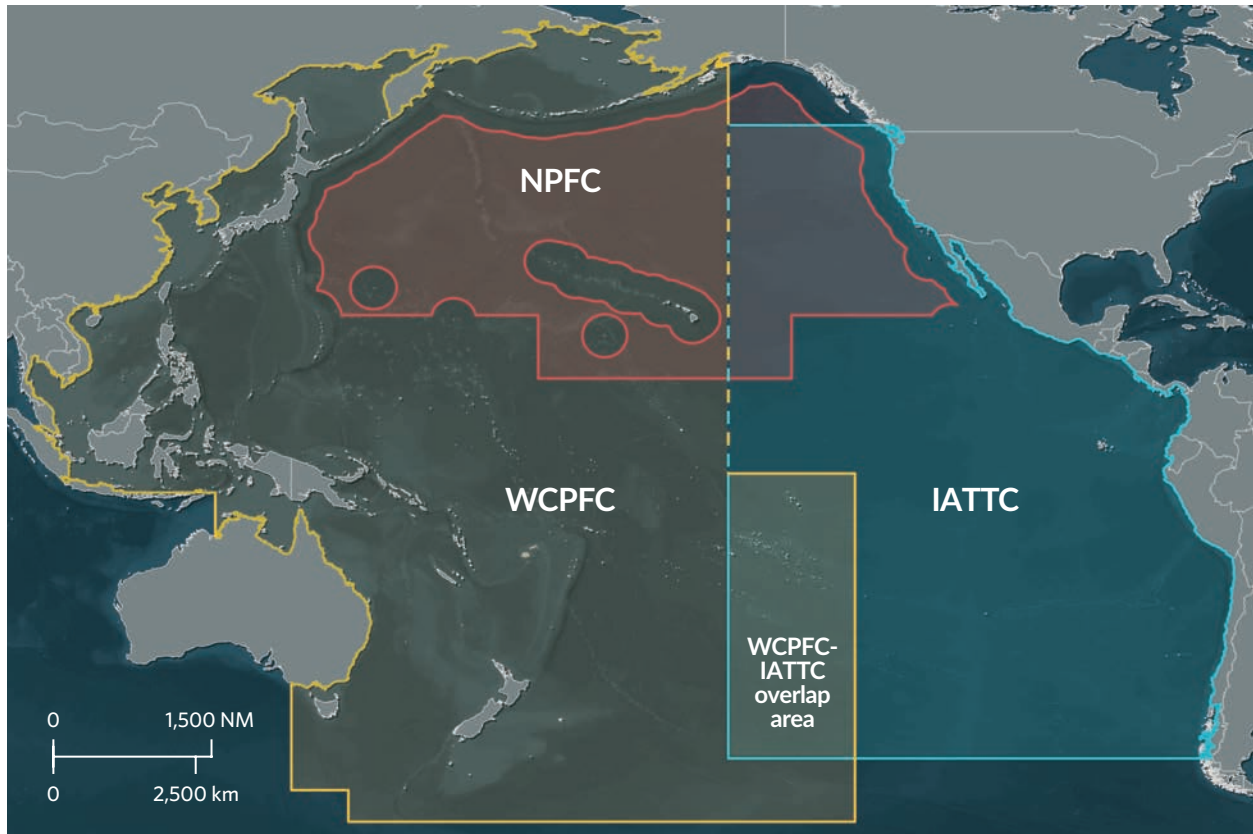
The WCPFC defines transshipment as "the unloading of all or any of the fish on board a fishing vessel to another fishing vessel either at sea or in port." Notably, the Commission asked CCMs to encourage their vessels to transship in port. It then developed procedures for CCMs to obtain and verify data on the quantity and species transshipped both in port and at sea in the Convention area, and procedures to determine when transshipment covered by this Convention has been completed.

As shown in Figure 1, WCPFC's Convention area overlaps with two other RFMOs in the Pacific: the IATTC and the NPF. The WCPFC Convention area also includes the exclusive economic zones (EEZs) of many of its members, including 15 Pacific island countries, New Zealand, part of Australia and eight non-contiguous EEZs of the United States. The area's western and northern sides have no defined borders.

Figure 1

Regional Fisheries Management Organizations in the Pacific

WCPFC, NPFC, and IATTC Convention areas overlap across the Pacific



Note: One nautical mile equals 1.15 miles.

Sources: WCPFC and IATTC, via United Nations Food and Agriculture Organization (FAO), <http://www.fao.org/geonetwork/srv/en/main.home>; NPFC https://www.npfc.int/about_npfc/convention_and_npfc_area_of_application/npfc-shape-file; and Land and Bathymetry from Natural Earth

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In 2009, the Commission adopted Conservation and Management Measure (CMM) 2009-06 - Regulation on Transshipment.⁸ This measure is broken into three sections, with transshipment management measures divided based on fishing location (e.g., high seas, EEZ, port) and vessel type:

- **Section 1** provides the general rules governing management of transshipment. Although the CMM states that the rules apply to all transshipments of highly migratory species caught in the Convention area, it excludes catch taken and transshipped within archipelagic waters or territorial seas. Likewise, rules governing transshipment in port or in waters under national jurisdiction (EEZs) are left subject to the national laws of the relevant port or coastal State CCM.

- **Section 2** covers transshipment by purse seiners, prohibiting transshipment on the high seas of the Convention area. Although the Commission generally prohibits at-sea transshipment by purse seiners, the CMM provides for exemptions. Three purse seine fleets—flagged by Papua New Guinea, the Philippines, and New Zealand—have this exemption.
- **Section 3** applies to all other vessel types, such as longline, troll and pole-and-line vessels. While transshipment by these vessels is also prohibited on the high seas, CCMs can advise the Commission that it is “impracticable for certain vessels that it is responsible for to operate without being able to transship on the high seas.”⁹

CCMs have taken advantage of this allowance, and high seas transshipments, primarily by longliners, have become the norm rather than the exception.

Regarding high seas transshipment reporting, the measure stipulates that CCMs are responsible for reporting on both offloading and receiving vessels and must notify the secretariat at least 36 hours before each transshipment. In addition, once the transshipment takes place, CCMs must give the secretariat a Transshipment Declaration within 15 days.

As allowed by the measure, most CCMs have delegated this reporting responsibility to the vessel masters or operators. The offloading and receiving vessels must complete a declaration for each transshipment and transshipment of catch taken in the Convention area. Masters and operators must report such activity to the secretariat when it happens on the high seas.

For transshipments that occur within EEZs and in port, the vessels involved must follow coastal State reporting requirements. The relevant coastal, flag and/or port State CCM is responsible for reporting these events to the secretariat as part of its Annual Report Part 1 reporting obligations. The measure requires that observers be deployed on carrier vessels for all transshipments at sea. But it does not require these observers to submit a report or otherwise independently verify the amount and type of fish being transshipped on the high seas. These reports are ostensibly provided to the carrier vessel’s flag State authorities, but it is unknown how they are used.

Carrier vessel activity in the WCPFC Convention area in 2016

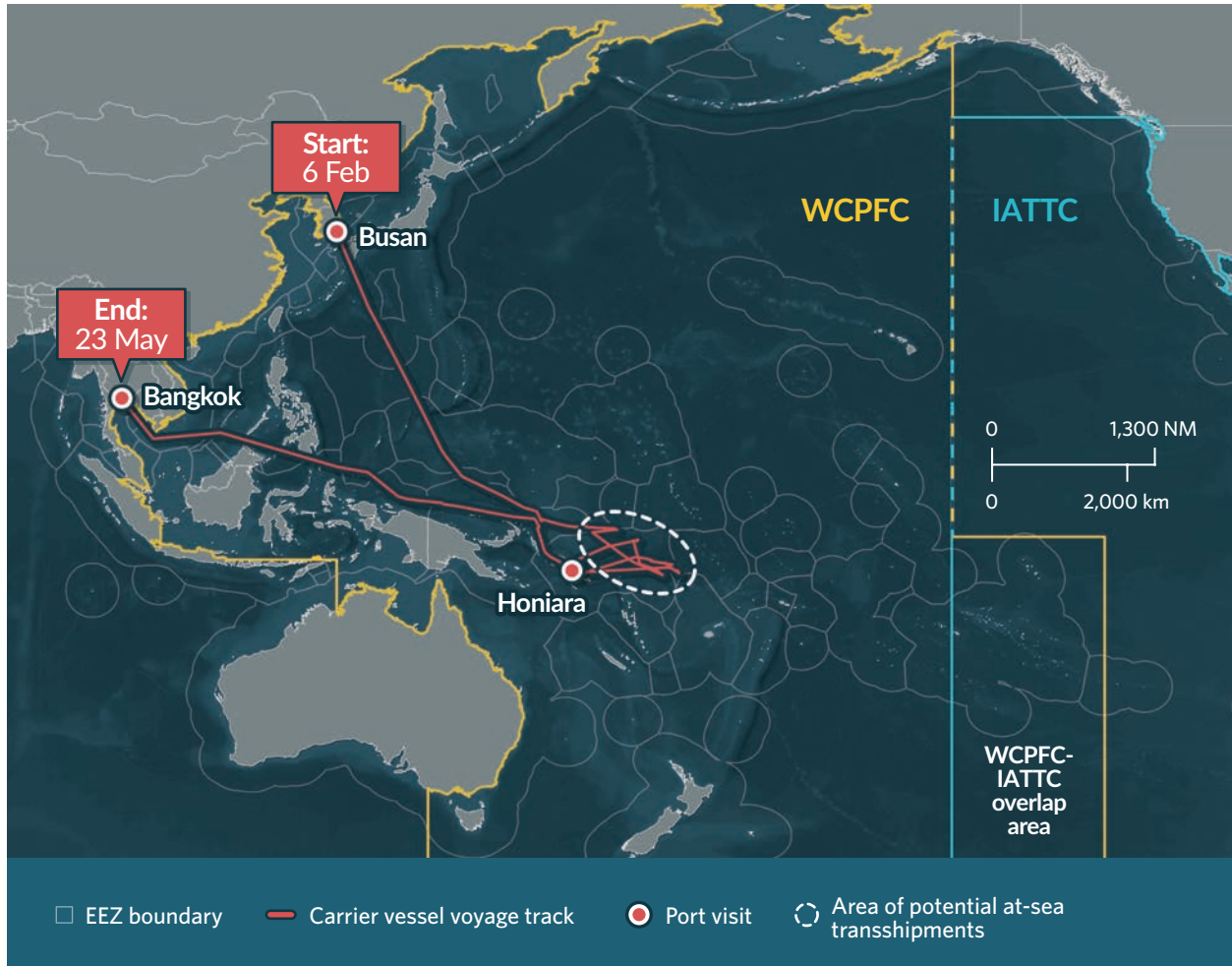
In 2016, authorized carrier vessels observed on AIS operating in the WCPFC Convention area demonstrated four distinct voyage profiles that Pew categorized based on their movements at sea and the port visits they made in Asia and the Pacific. Figures 2a through 2d highlight carrier vessels whose voyages were typical of each profile.

- **Complex carrier voyage** (Figure 2a) shows a transit into the WCPFC Convention area, a combination of movements on the high seas within EEZs and port visits, followed by a transit back to an Asian port.
- **EEZ and multiple ports voyage** (Figure 2b) highlights a transit into the WCPFC Convention area, a combination of movements within EEZs and port visits, followed by a transit back to an Asian port.
- **Ports-only voyage** (Figure 2c) shows a transit into the WCPFC Convention area to specific Pacific ports and then a transit back to an Asian port.
- **IATTC and WCPFC voyage** (Figure 2d) highlights a combination of vessel movements in WCPFC and IATTC Convention areas in a single voyage.

Figure 2

Common Carrier Vessel Voyages in the Pacific in 2016

2a: Complex carrier voyage profile with high seas, EEZs, and ports



Note: One nautical mile equals 1.15 miles.

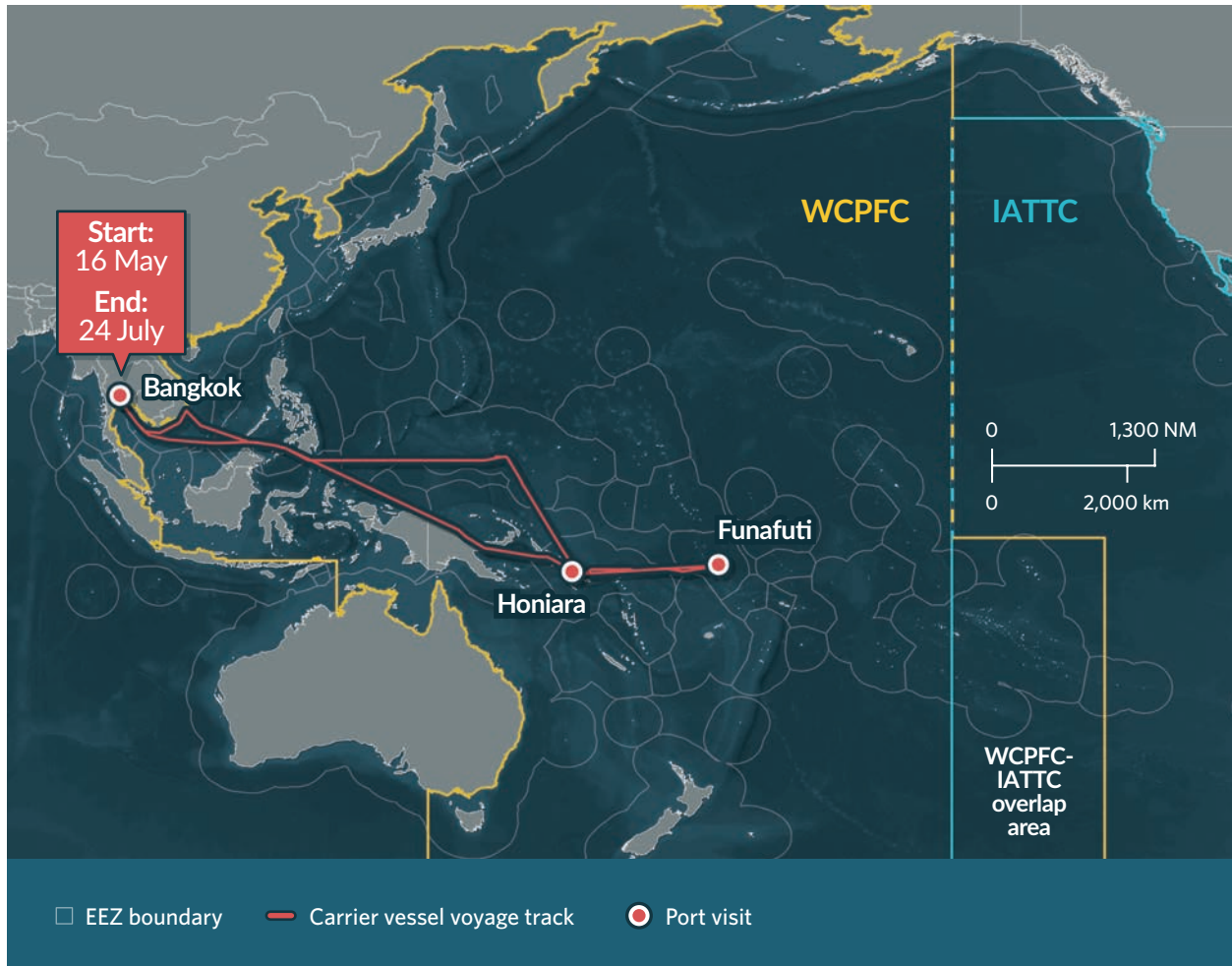
Source: Tracks from © 2019 OceanMind Limited; includes material © 2016 exactEarth Ltd.; EEZs from MarineRegions.org; and Land and Bathymetry from Natural Earth

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Figure 2

Common Carrier Vessel Voyages in the Pacific in 2016

2b: EEZ and multiple ports voyage profile



Note: One nautical mile equals 1.15 miles.

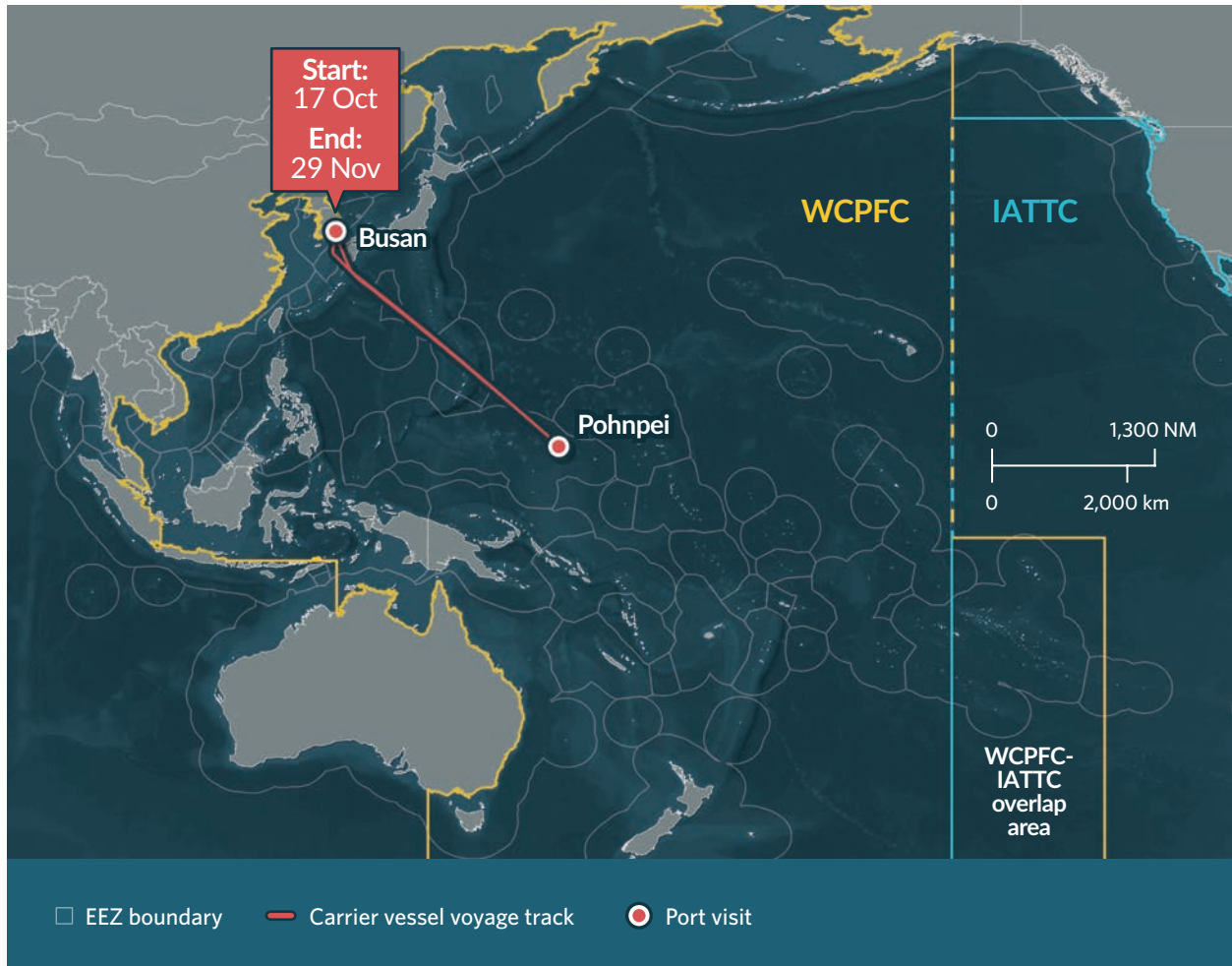
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Figure 2

Common Carrier Vessel Voyages in the Pacific in 2016

2c: Ports-only voyage profile with direct transit in and out of port



Note: One nautical mile equals 1.15 miles.

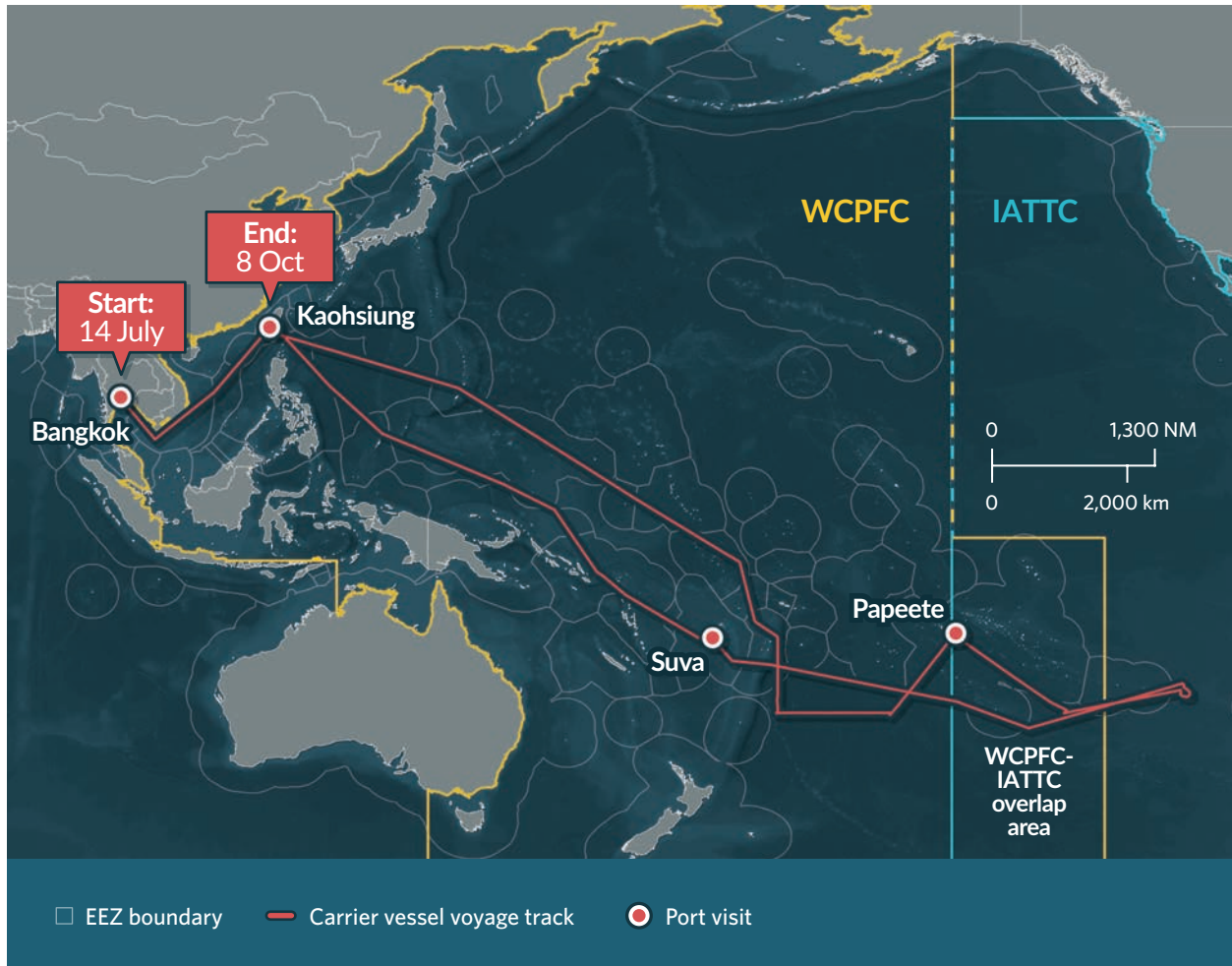
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Figure 2

Common Carrier Vessel Voyages in the Pacific in 2016

2d: IATTC and WCPFC voyage profile with activity in IATTC and WCPFC



Note: One nautical mile equals 1.15 miles.

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AIS analysis of WCPFC-authorized carrier vessels

By analysing AIS data, visualisation tools and publicly available reports on transshipments, carrier fleet trends based on the carrier vessel's flag State began to emerge. The secretariat-produced RFV¹⁰ listed 625 carrier vessels that were authorized to operate in the Convention area in 2016. Of these, 17 changed flags at some point that year. Ten carrier vessels changed flags to Panama, four to Liberia, one to South Korea, one to the Philippines, and one to Dominica, which is not a member of the WCPFC. Taking the flag changes into account brings the actual number of vessels to 609. For this study, carrier vessels were included in the count for any CCM under which they were flagged for at least part of 2016.

Table 1 shows the following breakdown of carrier vessels by flag State and the location of their operations as observed on AIS:

- **Total carriers** represents the number of carrier vessels authorized on the WCPFC RFV in 2016. Pew used 625 because it reflects the number of authorized carrier vessels, even though it equates to 609 distinct carrier vessels.
- **Carriers not on AIS** are vessels that were not detected on AIS. Pew could not determine the movements of 381 carrier vessels at any point in 2016.
- **Pacific carriers** represents the number of carrier vessels with any type of activity on the high seas, within EEZs or at port in the WCPFC Convention area other than direct and continuous transits to/from other regions of the world.
- **Asia/U.S. ports-only carriers** represents carrier vessels that exhibited only direct transits at sea between ports in Asia and U.S. ports in Alaska.
- **Non-Pacific carriers** represents carrier vessels whose movements on AIS occurred in other regions of the world, not in the Pacific.

Categorizing carrier vessels in this manner allowed trends to emerge regarding their activity across the WCPFC Convention area.

The WCPFC-authorized carrier vessel fleet in 2016 was registered and flagged to 16 different flag States, as outlined in Table 1. Although owner information was not consistently available in the RFV, Pew estimated that over 20 per cent were registered and owned by companies based in countries other than their flag State. Liberian-, Panamanian-, and Vanuatuan-flagged carrier vessels were registered and owned by companies from a large variety of countries, most of which were not associated with the flag State. No companies based in Liberia owned any of the 32 Liberian-flagged carriers. And 65 of the 105 Panamanian-flagged and 18 of the 22 Vanuatuan-flagged carrier vessels were owned by companies not based in those countries. These three flag State CCMs each have open vessel registries, often called “flags of convenience” because registration is open to any foreign-owned vessels. This practice is contentious because many contend that a flag State must have a genuine link with a vessel's ownership so that it can effectively exercise its jurisdiction and control over the vessel.¹¹

Table 1 shows that of the 244 authorized carrier vessels observed on AIS, 140 operated under 147 flag State authorizations and were categorized as Pacific carriers. Over 31 per cent of the authorized carrier vessels were active in non-Pacific regions, and about 8 per cent appeared to transit directly between Asian ports and U.S. ports in Alaska.

Table 1

Categorizing Carrier Vessels Authorized in the WCPFC Convention Area in 2016

	Flag State	Carriers not on AIS	Authorized Pacific carriers	Asia/U.S. ports-only carriers	Non-Pacific carriers	Total authorized carriers
Reported high seas transshipping	Liberia	0	3	2	27	32
	Panama	5	66	9	25	105
	South Korea	3	30	0	2	35
	Chinese Taipei	5	14	0	2	21
	Vanuatu	4	13	0	5	22
Did not report high seas transshipping	China	2	6	0	4	12
	Federated States of Micronesia	0	1	0	0	1
	Indonesia	26	0	0	0	26
	Japan	61	1	9	0	71
	Kiribati	2	7	0	1	10
	Lithuania	0	0	0	4	4
	Netherlands	0	0	0	2	2
	Philippines	269	5	0	0	274
	Marshall Islands	0	1	0	0	1
	Spain	1	0	0	0	1
	Thailand	3	0	0	5	8
	Total authorized carriers	381	147	20	77	625
	Total distinct carriers	378	140	20	71	609

Source: Pew analysis and categorization of information from the WCPFC Record of Fishing Vessels based on exactEarth AIS data and OceanMind algorithms

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All told, Pew's analysis of AIS data found that over 100 carrier vessels flagged to eight CCMs may have conducted almost 2,240 transshipments at sea in WCPFC waters in 2016. However, this count does not include:

- The potential transshipments conducted by the additional 381 carrier vessels not observed on AIS.
- The transshipments that may have taken place between longline vessels but were not reported.
- The number of transshipment events that may have occurred but were not reported during significant AIS gap periods observed with 70 of the Pacific carriers.

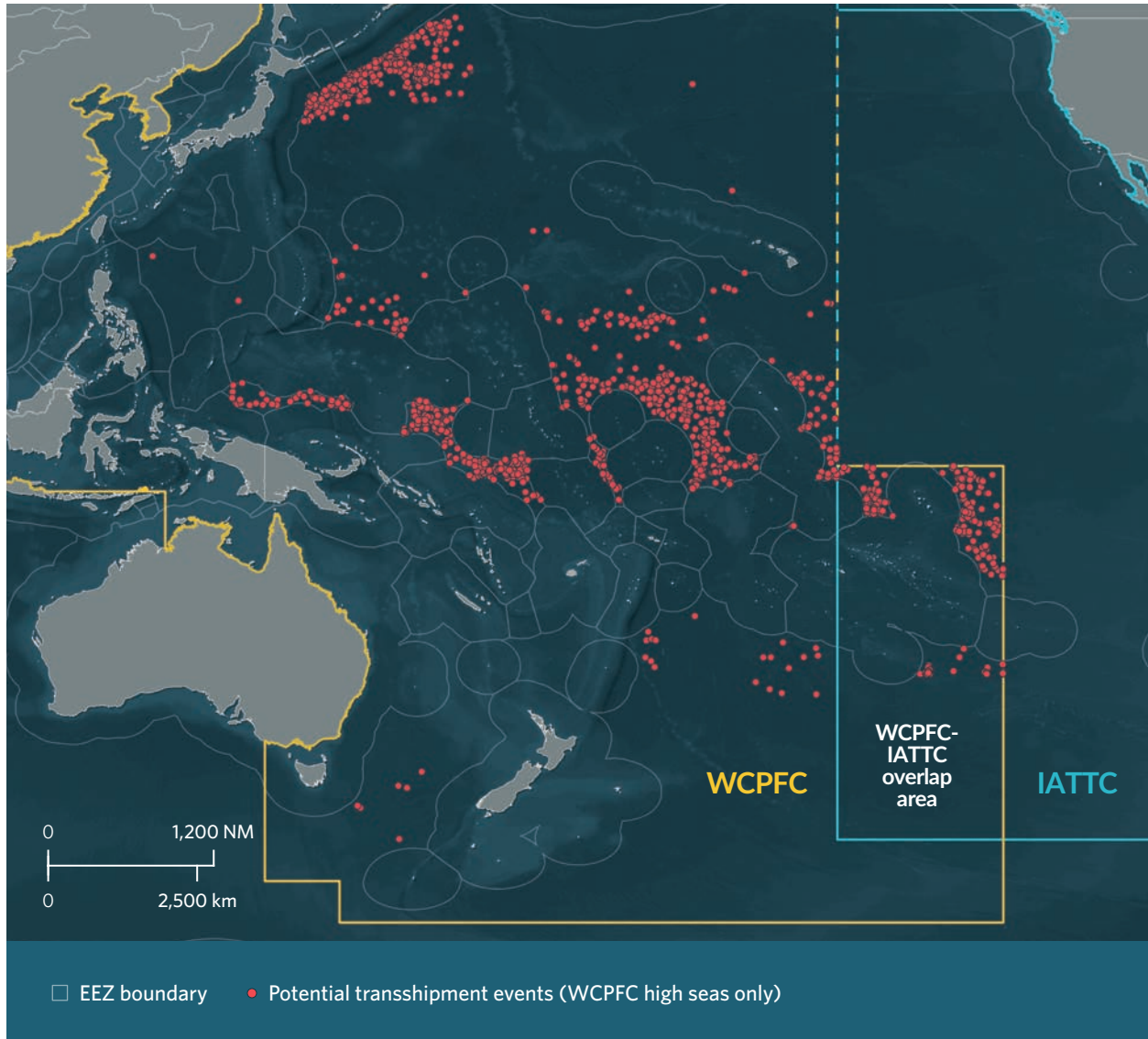
Figures 3, 5, and 6 highlight the spatial distribution of the 1,538 transshipment events that may have occurred on the high seas and the 703 in EEZs in the WCPFC Convention area, as detected through AIS data. The patterns of high seas events proved very similar to Figure 4, the WCPFC secretariat's visualisation of high seas transshipments in its annual report on transshipment.¹² This gave Pew confidence in the methods it used in this study to identify potential at-sea transshipments. The one notable exception is on the high seas off Japan, which will be discussed later in the report.

Finding: At least 140 carrier vessels operated in WCPFC Convention area waters in 2016, while only 25 carrier vessels submitted high seas transshipment reports to the secretariat as required. Very little reported information is available detailing the transshipment activities of the remaining carrier vessels.

Figure 3

Potential Transshipment Events on the High Seas in 2016

Spatial distribution of potential events in the WCPFC Convention area



Note: One nautical mile equals 1.15 miles.

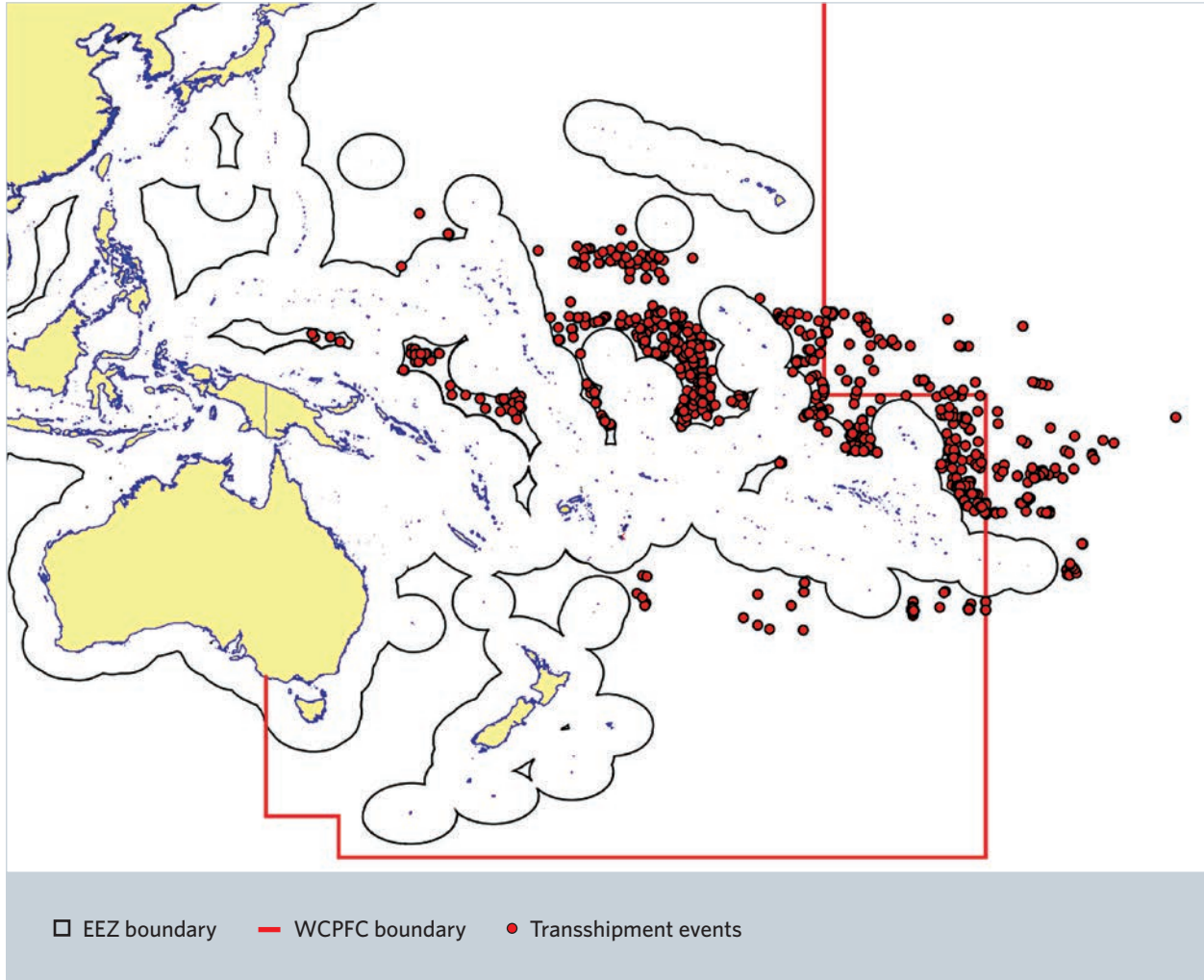
Source: Events from © 2019 OceanMind Limited; includes material © 2016 exactEarth Ltd.; EEZs from MarineRegions.org; and Land and Bathymetry from Natural Earth

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Figure 4

WCPFC-Reported Transshipments of Highly Migratory Fish Stocks in 2016

Spatial distribution of reported high seas transshipment events

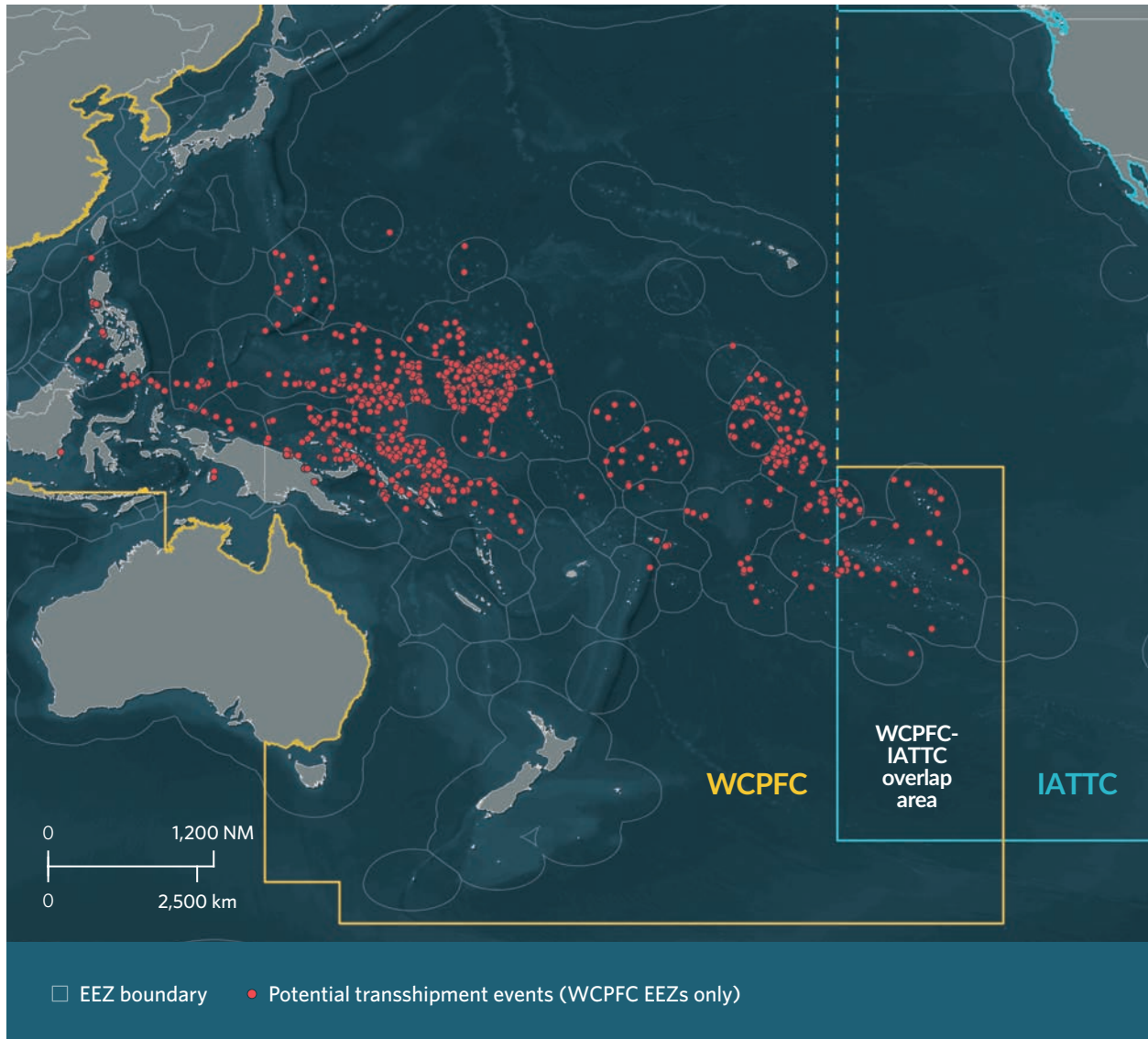


Source: Western and Central Pacific Fisheries Commission Technical and Compliance Committee, "Annual Report on WCPFC Transshipment Reporting, With an Emphasis on High Seas Activities" (2017), <https://www.wcpfc.int/node/29898>

Figure 5

Potential Transshipment Events in WCPFC-Convention Area EEZs in 2016

Spatial distribution



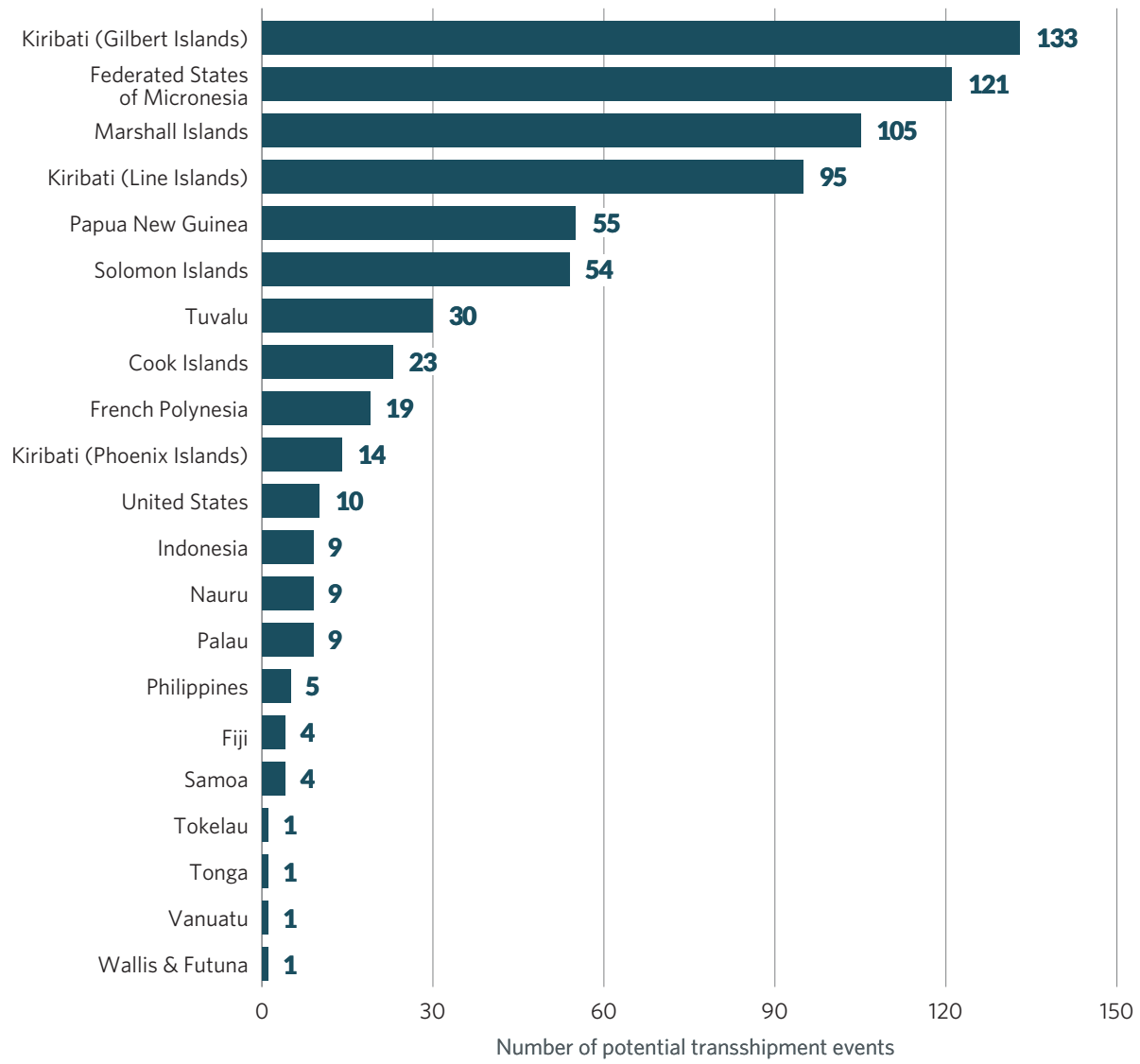
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Figure 6

Potential EEZ Transshipments by Location in 2016



Source: Pew analysis of EEZ potential transshipment activity described by exactEarth AIS data and OceanMind algorithms

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Historically, carrier vessels have been widely defined as refrigerated cargo vessels 300 gross tons (GT) or larger that operate on international voyages. These larger carrier vessels are mandated by the International Maritime Organization (IMO) to carry and use AIS transponders.¹³ But only 60 per cent of WCPFC-authorized carrier vessels this size were found to be transponding on AIS. It's possible that some carrier vessels not transponding on AIS could have spent 2016 tied up in port or undergoing refits or other maintenance in a shipyard, but investigating this possibility was beyond the scope of this study. Overall, 36 per cent of the 625 carrier vessels listed in the RFV transponded on AIS that year.

Of the 381 carrier vessels not observed to be transponding on AIS, 356 were flagged to Japan, the Philippines or Indonesia. As shown in Table 2, most of these vessels were under 300 GT —so they did not fit the typical profile of a refrigerated cargo vessel—but were still listed on the RFV by their respective flag State as “carrier vessels.”



High seas transshipment conducted through carrier vessels is among the most common of all fishing-related activities, but with the least oversight.

Table 2
Carrier Vessel Weight by Flag State
 In gross tons (GT)

Flag State	Carriers < 300 GT	Carriers < 300 GT on AIS	Carriers ≥ 300 GT	Carriers ≥ 300 GT on AIS	Total distinct carriers
China	0	0	12	10	12
Federated States of Micronesia	0	0	1	1	1
Indonesia	25	0	1	0	26
Japan	29	2	42	8	71
Kiribati	0	0	10	8	10
Liberia	0	0	32	32	32
Lithuania (EU)	0	0	4	4	4
Netherlands (EU)	0	0	2	2	2
Panama	0	0	105	96	105
Philippines	194	0	80	5	274
Marshall Islands	0	0	1	0	1
South Korea	0	0	35	29	35
Spain (EU)	0	0	1	0	1
Chinese Taipei	2	1	19	14	21
Thailand	0	0	8	5	8
Vanuatu	2	0	20	11	22
Total	252	3	373	225	625

Source: WCPFC's Record of Fishing Vessels, <https://www.wcpfc.int/doc/historical-record-fishing-vessels-rfv-data>

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In addition to the number of carrier vessels not transponding on AIS, this study does not capture the potential number of transshipments at sea within the WCPFC Convention area between two longliners. On a handful of occasions, vessels have experienced a serious mechanical breakdown and have reported transshipment activity to the secretariat,¹⁴ but the extent to which this occurs has not been investigated. Given the limitations of AIS coverage on longliners, an analysis of the extent of this practice is probably better accomplished by the WCPFC secretariat using VMS data.

For the 140 Pacific carriers, 70 demonstrated gaps in AIS coverage during their voyages of more than 24 hours, in some cases extending to days or even weeks. Overall, more than 250 significant AIS gaps were documented, as outlined in Table 3. Most of these gaps were associated with carrier vessels flagged to Chinese Taipei, Panama, South Korea, China, and the Philippines. All of Chinese Taipei's 14 vessels, 57 per cent of China's vessels, and about 40 per cent of both South Korea's and Panama's had significant AIS gaps. Transshipment events that were not reported may have occurred during these gaps.

Table 3
Significant AIS Gaps by Pacific Carriers

Flag State	Authorized Pacific carriers	Authorized Pacific carriers with AIS gaps observed	Number of significant gaps in AIS
China	6	4	30
Federated States of Micronesia	1	1	4
Japan	1	1	2
Kiribati	7	6	16
Liberia	3	0	0
Panama	66	26	49
Philippines	5	5	35
Marshall Islands	1	1	13
South Korea	30	12	41
Chinese Taipei	14	14	66
Vanuatu	13	0	0
Total	147	70	256

Source: OceanMind Ltd. (2019); includes material from exactEarth Ltd. (2016)

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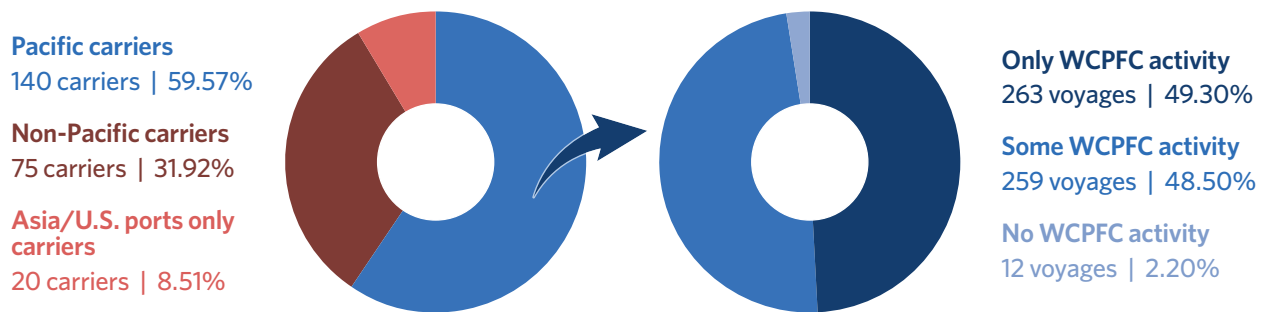
Based on this study's definition of "voyage," the 140 Pacific carriers (Figure 7) made 533 distinct voyages in 2016. Nearly half took place entirely in WCPFC Convention area waters. Over 47 per cent covered the wider Pacific and involved operating in both WCPFC and IATTC Convention area waters in a single voyage. The remaining 2.2 per cent represented a small subset of voyages taken by carrier vessels transiting between Asian and U.S. Alaskan ports. While the AIS gaps make the data incomplete, the vessel tracks showing where these Pacific carriers spent their time at sea provide valuable insight into transshipment activities in WCPFC waters that year.

Figure 7

Localities of Authorized Carriers' Voyages on AIS in the WCPFC Convention Area in 2016

WCPFC carrier categories based on activity

Locality of voyages for Pacific carriers

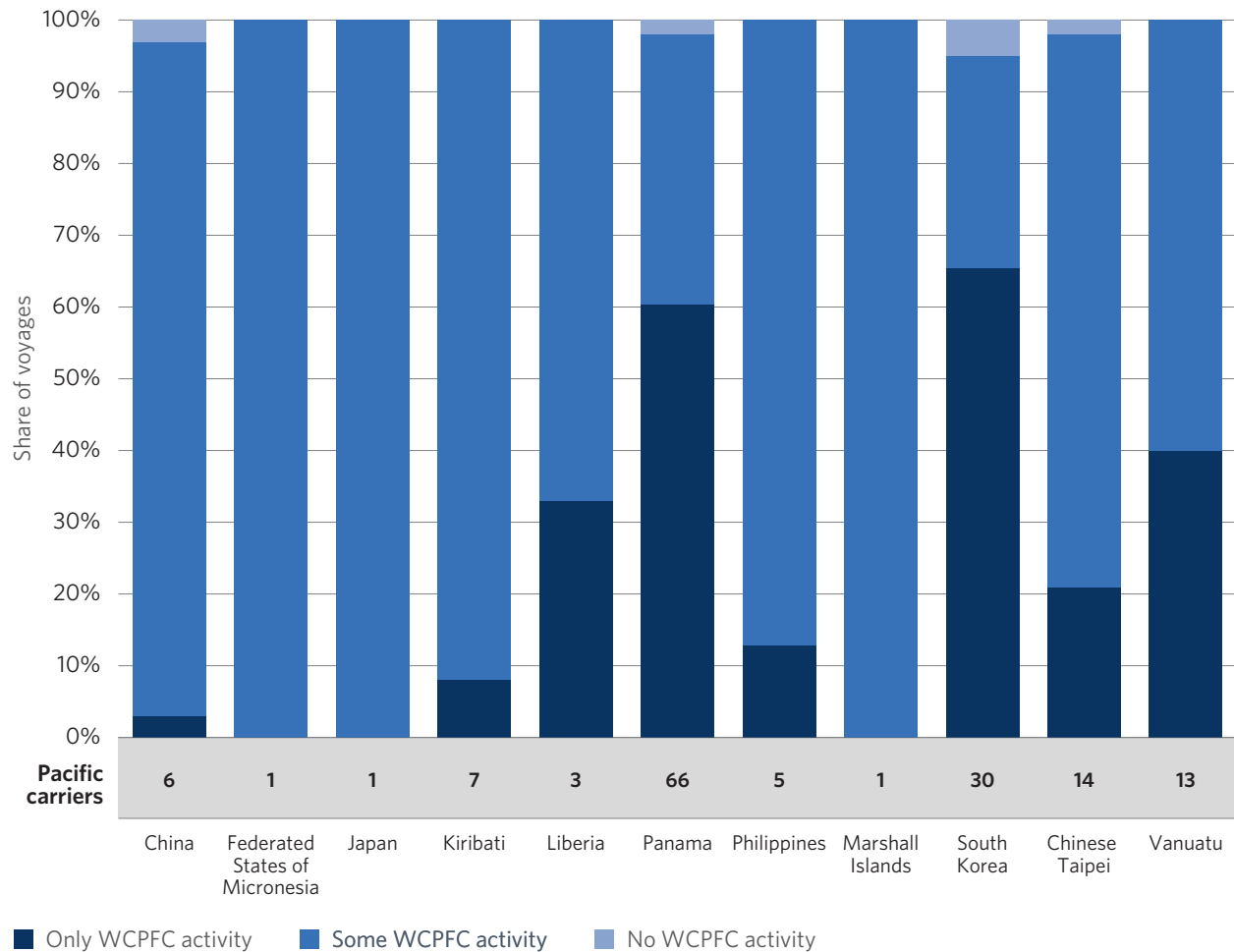


Source: Pew analysis of exactEarth AIS and OceanMind algorithms

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Tracking the Pacific carrier fleet uncovered patterns in voyages based on their flag State (Figure 8). For instance, 93 percent of the voyages by China's six Pacific carriers were in WCPFC Convention area waters, while Chinese Taipei's 14 carriers and Kiribati's seven showed much more diverse movements that extended east into IATTC Convention area waters.

Figure 8
Voyage Profiles by Flag State



Source: Pew analysis of transshipment activity based on exactEarth AIS data and an OceanMind algorithm

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Where did transshipment happen?

Nearly 1,540 potential transshipment events occurred on the high seas in the WCPFC Convention area in 2016, based on AIS analysis of movements of Pacific carriers that were consistent with transshipment activity. This estimate is over 60 per cent higher than the 956 high seas transshipment events that vessel operators reported to the WCPFC (as updated in the Commission’s annual report on transshipment for 2018).¹⁵

More than 700 additional transshipments may have occurred within the EEZs of coastal States that are part of the Convention. However, carrier vessels operating within EEZs are not subject to the same WCPFC reporting requirement as those operating on the high seas, per the WCPFC transshipment measure.¹⁶ The absence of this requirement prevented a comparison of the number of potential and reported EEZ events, as was done for high seas transshipments. Pew attempted to determine the actual number of EEZ transshipments by referencing the Annual Report Part 1 submissions of the Pacific carriers vessel’s flag State or the coastal State where events occurred. Unfortunately, a review of these submissions found almost no reporting of transshipments in EEZs.

Finding: A strong possibility exists that more at-sea transshipment events occurred than were reported to the WCPFC by carrier vessels themselves or relevant flag and coastal State authorities.

Pacific carriers visited ports in the Pacific 620 times in 2016 (Figure 9). Transshipment likely took place during these Pacific port visits, given the WCPFC requirement for purse seiners to transship in port.¹⁷ That year, purse seiners caught about 68 per cent of the tuna taken in the western and central Pacific Ocean,¹⁸ with most of that catch transshipped from purse seiners to carrier vessels in Pacific ports.

Figure 9

Pacific Carrier Activity by Location in the WCPFC Convention Area in 2016

High seas, EEZs, and Pacific ports are focus areas for transshipments



Source: Pew analysis of potential transshipment activity based on exactEarth AIS data and an OceanMind algorithm

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Figure 10 shows the number of potential transshipments by Pacific carriers, broken down by flag State, highlighting not only the number of Pacific port visits where transshipments likely occurred, but also how many transshipments may have occurred on the high seas and within coastal State EEZs.

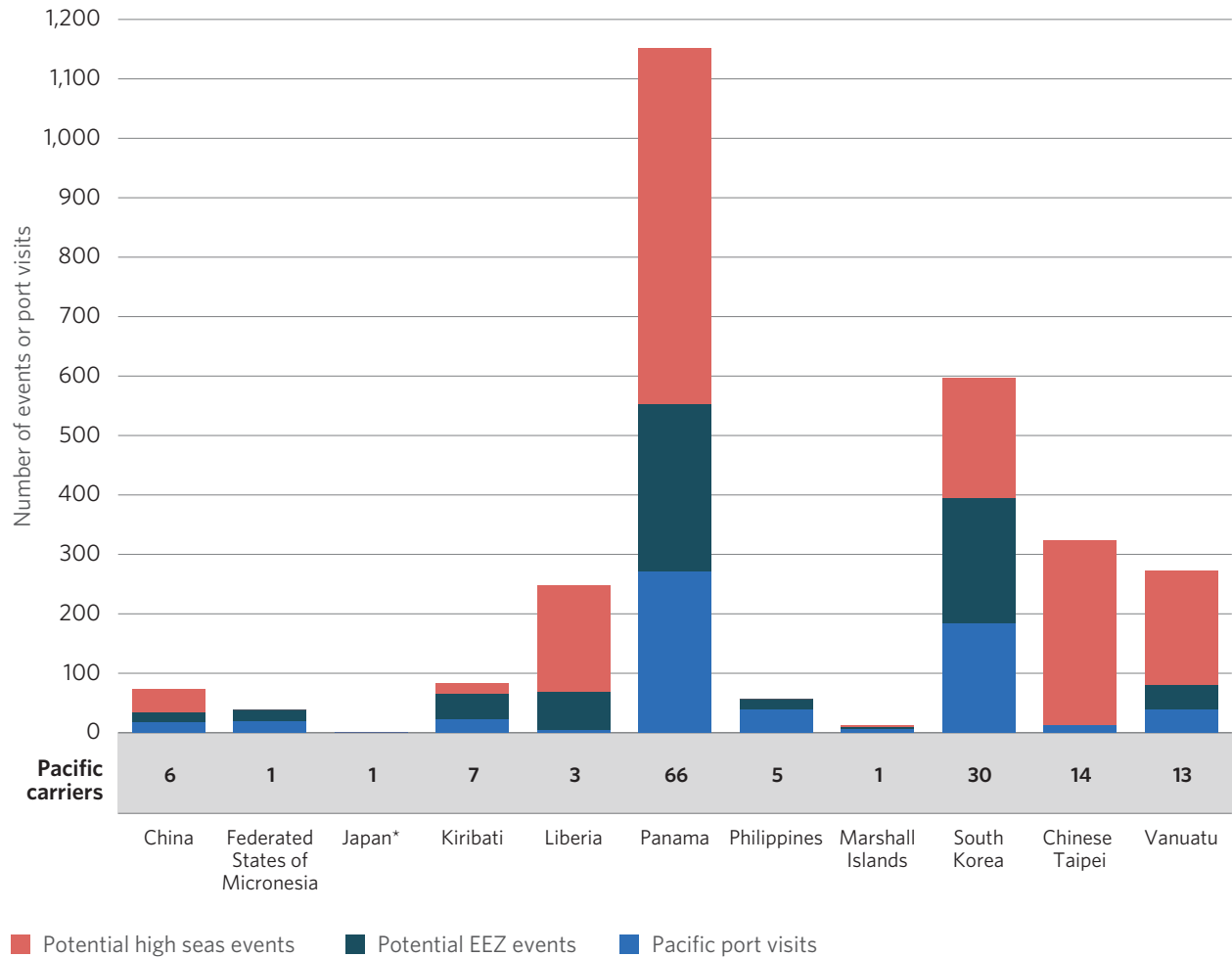
A large proportion of potential at-sea transshipment events appear to have taken place involving carrier vessels flagged to Panama. This was followed by South Korean-flagged carrier vessels. Chinese Taipei, Liberia, Vanuatu, and China also had carrier vessels that appeared to have been involved with at-sea transshipments. Five of these six flag States had carrier vessels that reported high seas transshipment events in 2016, with China the only CCM whose flagged carrier vessels did not report any. Unfortunately, China did not provide any information in its Annual Report Part 1 that could be used to corroborate the number of its carrier vessels involved with high seas transshipments.

Figure 11 shows Pacific, Asian and non-WCPFC port usage by Pacific carriers in 2016 based on the vessel's flag State. All 140 Pacific carriers visited Asian ports in 2016, accounting for 842 total visits. The vast majority of them use Asian ports to offload transshipped fish for processing.

Figure 10

Detected Transshipments by Category and Flag State in the WCPFC Convention Area in 2016

Panamanian-flagged carriers had the most potential transshipment activity



*Japan had one Pacific port visit

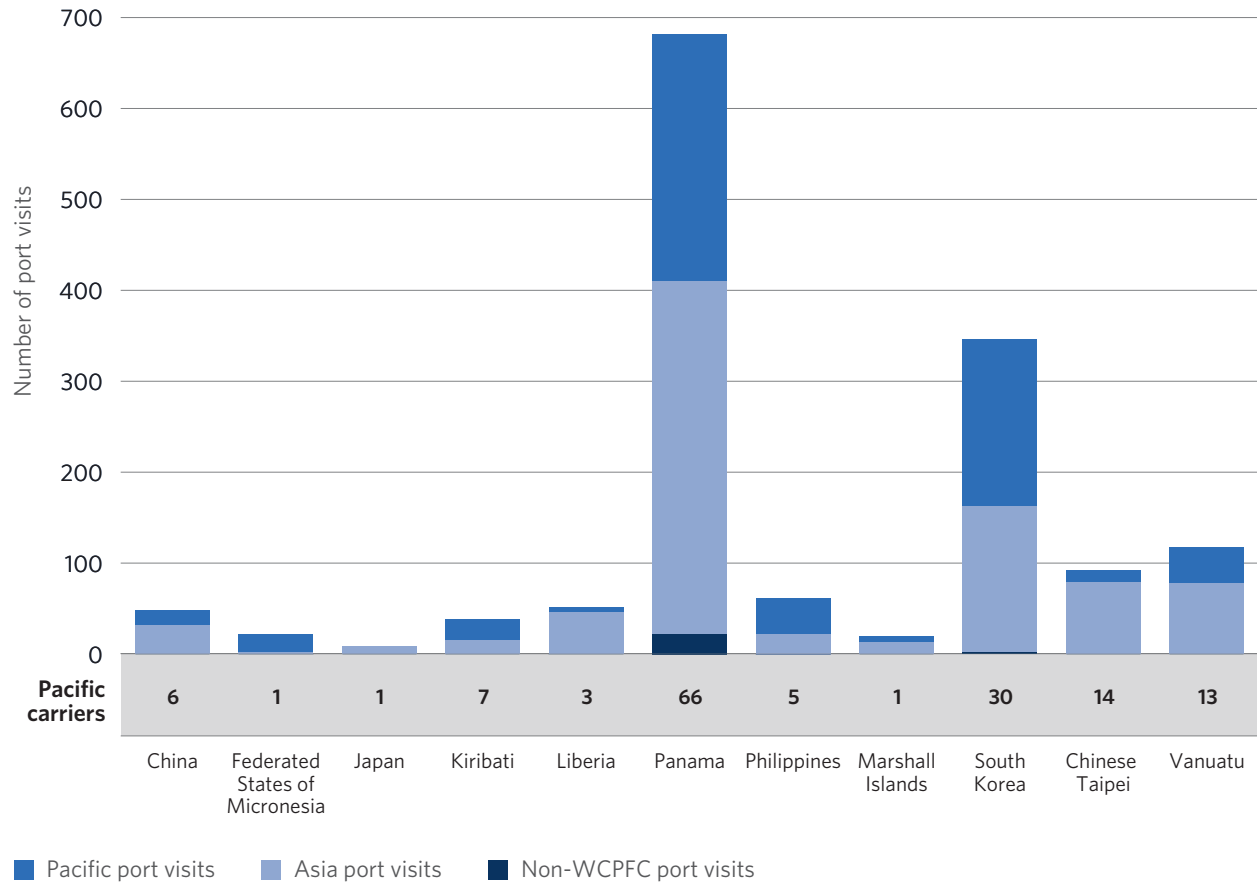
Source: Pew analysis of potential transshipment activity based on exactEarth AIS data and an OceanMind algorithm

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Figure 11

Detected Port Visit Locations by Flag State in the WCPFC Convention Area in 2016

Where did port visits occur, by vessels flagged to which state?



Source: Pew analysis of potential transshipment activity based on exactEarth AIS data and an OceanMind algorithm

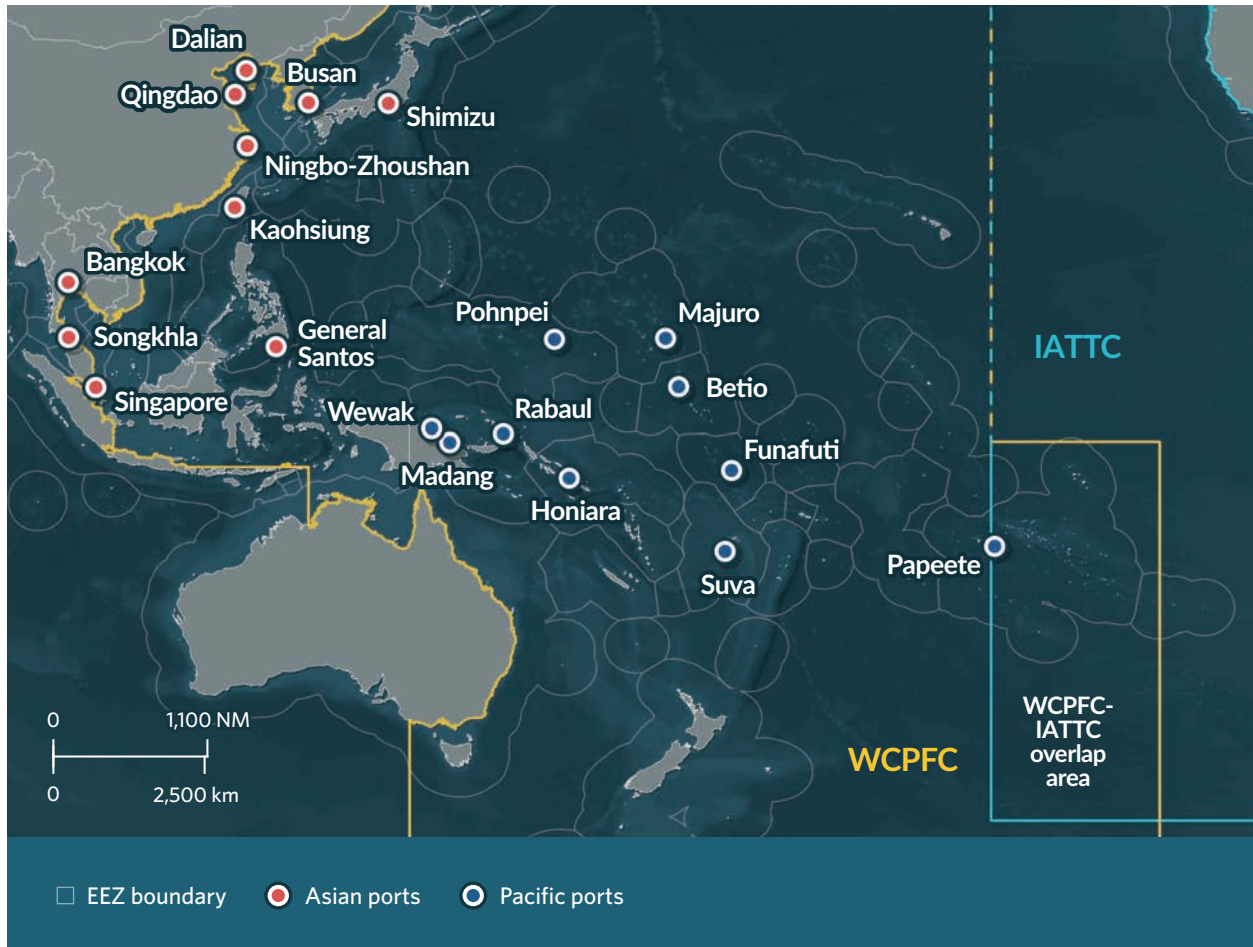
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Figure 12 shows the top 10 ports in Asia and the Pacific visited by carrier vessels. The location of each port is important because it could provide a preliminary basis for determining whether a country would benefit from adherence to the U.N. Food and Agriculture Organization (FAO) Port State Measures Agreement or implementing enhanced port State measures and port inspection capability given the amount of port usage by carrier vessels. This is especially true for the Marshall Islands, Kiribati, the Federated States of Micronesia, and Pacific island countries that received the most port visits by carrier vessels.

Figure 12

Top 10 Asian and Top 10 Pacific Ports Visited by Carrier Vessels in the WCPFC Convention Area in 2016

Carriers detected on AIS visited Busan and Majuro the most



Note: One nautical mile equals 1.15 miles.

Source: Tracks from © 2019 OceanMind Limited; includes material © 2016 exactEarth Ltd.; EEZs from MarineRegions.org; and Ports, Land and Bathymetry from Natural Earth

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Reporting of transshipments by the WCPFC and its members

Review of WCPFC public domain data

In addition to using AIS data to analyse the movements of Pacific carriers, Pew examined public reports on transshipment activity in the Convention area on the WCPFC's website (www.wcpfc.int). It specifically analysed annual reports produced by either the WCPFC secretariat or relevant CCMs on activities related to transshipment and carrier vessels that were reported to have occurred in 2016.

This analysis highlighted the significant degree to which transshipment activities go unreported to the WCPFC secretariat by CCMs and the existence of big discrepancies between transshipment activity reported by carrier vessels and CCMs. Some of the data reporting gaps are due to a genuine lack of reporting, but they also appear to be a result of a lack of standardized, detailed reporting requirements.

These discrepancies make it difficult for any organization to independently verify data—or even perform a simple audit. A more complete picture of transshipment activity could be gained by reviewing non-public information held by the secretariat, such as data from the WCPFC vessel monitoring system (VMS), observer reports and transshipment declarations. However, no comprehensive internal or external audit on transshipment has been conducted.

The data gaps, reporting anomalies and non-standardized reporting pose clear risks to transshipment monitoring and control. The Commission should consider tasking the secretariat with carrying out a study that builds upon this report's findings by using the non-public-domain data that the secretariat holds and maintains.

Finding: Data gaps, reporting anomalies, and non-standardized reporting on carrier vessel transshipments provided by WCPFC CCMs increase the risk that transshipment activities go unreported and unverified.

Transshipment reporting

Twenty-five carrier vessels flagged to five WCPFC members (three flagged to Chinese Taipei, three to Liberia, nine to Panama, three to South Korea and seven to Vanuatu) reported transshipment events on the high seas in the WCPFC Convention area during 2016,¹⁹ as shown in Table 4. Only Liberia provided sufficient information on carrier vessels in its Annual Report Part 1²⁰ to corroborate the reports by its carrier vessels. Liberia and Vanuatu did not break down how many transshipment events occurred on the high seas and how many occurred within EEZs.

The number of carrier vessels on the high seas that showed movements on AIS consistent with transshipment activity was significantly higher, however, than the number of vessels that reported such events. As many as 92 carrier vessels flagged to these five CCMs may have transshipped WCPFC-managed species on the high seas in 2016, significantly more than the 25 that reported such events.

Table 4

Reported and Detected Transshipping by Flag State

The number of carriers detected potentially transshipping on the high seas far exceeds what was reported

	Flag State	Flag State Annual Report Part 1 reported high seas events	Carrier vessels reported "fished" in WCPFC RFV ^Δ	Carrier vessels that reported high seas events, as listed in the WCPFC Annual Report [◊]	Total AIS-detected authorized Pacific carrier vessels	AIS-detected authorized Pacific carrier vessels with potential high seas events
Reported high seas transshipping	Liberia	193 [†]	3	3	3	3
	Panama	Not reported [‡]	76	9	66	46
	South Korea	79 [§]	29	3	30	21
	Chinese Taipei	Not reported [†]	6	3	14	11
	Vanuatu	326	16	7	13	11
Did not report high seas transshipping	China	Not reported [†]	10	0	6	4
	FSM	Not reported	1	0	1	0
	Indonesia	0 [‡]	0	0	0	0
	Japan	0 [§]	0	0	1	0
	Kiribati	0	8	0	7	4
	Lithuania	Not reported [#]	4	0	0	0
	Marshall Islands	Not reported	0	0	1	1
	Netherlands	Not reported [#]	0	0	0	0
	Philippines	Not reported ^{**}	99	0	5	0
	Spain	Not reported ^{‡‡}	0	0	0	0
	Thailand	0 ^{§§}	0	0	0	0
Total		598	252	25	147	101

- △ Western and Central Pacific Fisheries Commission, “Historical Record of Fishing Vessel (RFV) Data—as of 24 August 2018” (2018), <https://www.wcpfc.int/doc/historical-record-fishing-vessels-rfv-data>.
- ◊ Western and Central Pacific Fisheries Commission, Technical and Compliance Committee, “Annual Report on WCPFC Transshipment Reporting, With an Emphasis on High Seas Activities” (2017), <https://www.wcpfc.int/node/29898>.
- * Western and Central Pacific Fisheries Commission, “Annual Report to the Commission Part 1: Information on Fisheries, Research, and Statistics—Chinese Taipei” (2017), <https://www.wcpfc.int/node/29446>.
- † Western and Central Pacific Fisheries Commission, “Annual Report to the Commission Part 1: Information on Fisheries, Research, and Statistics—Liberia” (2017), <https://www.wcpfc.int/node/29400>.
- ‡ Western and Central Pacific Fisheries Commission, “Annual Report to the Commission Part 1: Information on Fisheries, Research, and Statistics—Panama” (2017), <https://www.wcpfc.int/node/30006>.
- § Western and Central Pacific Fisheries Commission, “Annual Report to the Commission Part 1: Information on Fisheries, Research, and Statistics—Republic of Korea” (2017), <https://www.wcpfc.int/node/29444>.
- || Western and Central Pacific Fisheries Commission, “Annual Report to the Commission Part 1: Information on Fisheries, Research, and Statistics—Vanuatu” (2017), <https://www.wcpfc.int/node/29445>.
- ** Western and Central Pacific Fisheries Commission, “Annual Report to the Commission Part 1: Information on Fisheries, Research, and Statistics—China” (2017), <https://www.wcpfc.int/node/29453>.
- † Western and Central Pacific Fisheries Commission, “Annual Report to the Commission Part 1: Information on Fisheries, Research, and Statistics—Micronesia” (2017), <https://www.wcpfc.int/node/29440>.
- ‡ Western and Central Pacific Fisheries Commission, “Annual Report to the Commission Part 1: Information on Fisheries, Research, and Statistics—Indonesia” (2017), <https://www.wcpfc.int/node/29432>.
- § Western and Central Pacific Fisheries Commission, “Annual Report to the Commission Part 1: Information on Fisheries, Research, and Statistics—Japan” (2017), <https://www.wcpfc.int/node/29415>.
- || Western and Central Pacific Fisheries Commission, “Annual Report to the Commission Part 1: Information on Fisheries, Research, and Statistics—Kiribati” (2017), <https://www.wcpfc.int/node/29442>.
- # Western and Central Pacific Fisheries Commission, “Annual Report to the Commission Part 1: Information on Fisheries, Research, and Statistics—European Union” (2017), <https://www.wcpfc.int/node/29424>.
- ** Western and Central Pacific Fisheries Commission, “Annual Report to the Commission Part 1: Information on Fisheries, Research, and Statistics—Philippines” (2017), <https://www.wcpfc.int/node/29401>.
- †† Western and Central Pacific Fisheries Commission, “Annual Report to the Commission Part 1: Information on Fisheries, Research, and Statistics—Marshall Islands” (2017), <https://www.wcpfc.int/node/29443>.
- ‡‡ MRAG Asia Pacific, “Towards the Quantification of Illegal, Unreported and Unregulated (IUU) Fishing in the Pacific Islands Region” (2016), <http://www.ffa.int/files/FFA%20Quantifying%20IUU%20Report%20-%20Final.pdf>.
- §§ Western and Central Pacific Fisheries Commission, “Annual Report to the Commission Part 1: Information on Fisheries, Research, and Statistics—Thailand” (2017), <https://www.wcpfc.int/node/29421>.

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Similar data gaps or anomalous reporting existed with information provided by the remaining flag States that also had authorized carrier vessels listed on the RFV²¹ but whose vessels did not report high seas transshipment activity. In addition to the five CCMs that had carrier vessels reporting high seas transshipment, 22 carrier vessels flagged to six of the remaining 11 CCMs with carrier vessels on the RFV were also observed on AIS operating in WCPFC Convention area waters in 2016. Nine of these carrier vessels (four flagged to China, four to Kiribati and one to the Marshall Islands) demonstrated vessel movements consistent with high seas transshipment events, but none reported such activity to the WCPFC secretariat. Likewise, China, Kiribati, and the Marshall Islands provided no information in their respective Annual Report Part 1 that could be used to confirm or dispute the activities of these carrier vessels, including whether the possible high seas transshipment events even occurred.

CCMs are required to also state in their respective Annual Report Part 1 how many of their flagged fishing and carrier vessels listed on the RFV either “fished” or “did not fish” in WCPFC Convention area waters beyond their national jurisdiction during the previous calendar year.²² An analysis of the 2017 “fished/did not fish” reporting

information for 2016 found a wide range of reporting discrepancies. For instance, for the five CCMs whose flagged carrier vessels reported high seas transshipments, Chinese Taipei authorities reported fewer carrier vessels to have “fished” in the area in 2016 than were detected on AIS.²³ And Panama and Vanuatu reported that more vessels “fished” that year than were detected on AIS.²⁴ While South Korea listed the same number that was observed on AIS, the correlation is not definitive because three carrier vessels flagged to South Korea were not observed transponding on AIS and their activities could not be determined.

Of the remaining 11 CCMs, six reported carrier vessel numbers that “fished” in the Convention area in 2016 that do not match the totals for those vessels that were detected on AIS.²⁵ These discrepancies make clear that the WCPFC “fished/did not fish” reporting requirement is not a reliable cross-referencing metric unless the numbers are linked to and consistent with VMS data. Discrepancies could then be resolved between the relevant flag State and the secretariat.

Finding: The WCPFC “fished/did not fish” reporting metric must be linked to and be consistent with VMS data and be verified by the secretariat to provide any reporting and auditing value.

RFMO Convention overlap areas

Carrier vessel movements and potential transshipments in RFMO overlap areas

The waters where the WCPFC overlaps with the IATTC and the NPFC may not be as closely monitored as is needed. Because multiple management regimes exist for the same waters, carrier vessels authorized by more than one of these RFMOs must comply with the rules and regulations of the RFMO in which their catch was made or the RFMO that manages the specific species being transshipped. In two of these areas—the IATTC/WCPFC overlap area and where the NPFC Convention area spans part of the WCPFC Convention high seas area off Japan—high concentrations of carrier vessels and potential transshipments were detected in 2016.

The three RFMOs do not require carrier vessels authorized by them to report their intent to transship species that the organization manages when they enter Convention area waters, or whether the carrier intends to transship species that are managed by another RFMO. The RFMOs also have different reporting and observer carriage requirements, making it difficult for the respective secretariats to determine which RFMO rules and procedures a carrier vessel is operating under in dually managed waters at any given time. As a result, the amount and type of species transshipped by a carrier vessel in such waters may go unreported.

Finding: The WCPFC, IATTC, and NPFC lack uniform transshipment reporting requirements, making it more likely that this activity will not be reported and tracked.

WCPFC/IATTC overlap area

Figure 13 shows an AIS analysis of potential high seas transshipment events in the IATTC/WCPFC overlap area in 2016 by carrier vessels flagged to six States. Vessel movements in this overlap area indicate that as many as 216 transshipments involving 22 carrier vessels may have occurred in this relatively small area of the Pacific managed by two RFMOs. This high number of events in this small area increases the odds that some of them go unreported to the appropriate RFMO. The fact that WCPFC carrier observers are not required to submit reports to the secretariat for high seas transshipments underscores this possibility.²⁶ In fact, the WCPFC secretariat stated that it had received only one observer report from a flag State for the 948 high seas transshipments (subsequently revised to 956²⁷) that carrier vessels reported in 2016.²⁸

Moreover, the IATTC carrier observer service provider does not have an agreement with the WCPFC secretariat to even collect data on transshipments in the Western Pacific.²⁹ This lack of collaborative information-gathering may make transshipment reporting less effective, especially if vessels carrying an IATTC observer transship in the IATTC/WCPFC overlap area with WCPFC-authorized fishing vessels whose catch was taken in its waters. Likewise, if these vessels move west into waters that are only under the WCPFC's jurisdiction, the IATTC carrier observer watches and documents WCPFC transshipments at the sole discretion of the carrier vessel captain,³⁰ an obvious management loophole.

With no data collection agreement in place, 18 of 439 transshipments by carrier vessels in WCPFC waters between January 2016 and March 2017 were not observed by the IATTC observer on board.³¹ The WCPFC annual transshipment report for 2016 also did not mention the 18 events.³² It is unknown whether the IATTC gave the WCPFC information regarding these unobserved events or whether the WCPFC secretariat accounted for them in its own annual transshipment report. As such, WCPFC transshipments by carrier vessels with only IATTC observers on board represent a potentially large data gap.

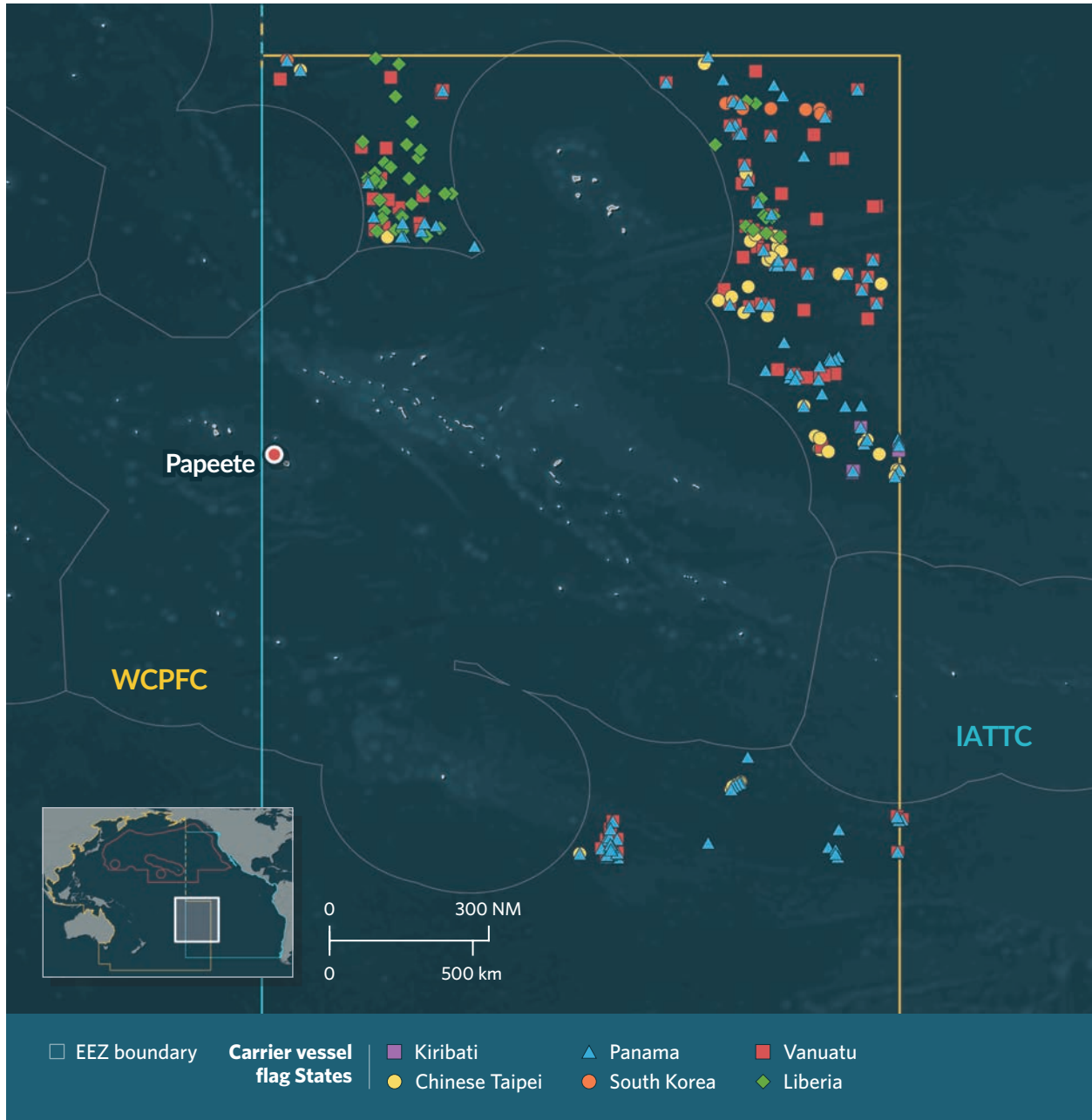
These factors contribute to the need for the WCPFC and IATTC secretariats to revise their data-sharing agreement to include the sharing of transshipment-related data and information such as transshipment declarations and observer reports. In addition, the agreement should allow for the IATTC carrier observer service provider to collect data on transshipments on the high seas in the WCPFC Convention area and submit it directly to the WCPFC secretariat.

Finding: The absence of data-sharing arrangements between the WCPFC and the IATTC on carrier vessel transshipments increases the risk that unreported transshipments may occur, especially by carrier vessels operating in the IATTC/WCPFC overlap area or in both Convention areas during the same voyage.

Figure 13

Potential High Seas Transshipments in the WCPFC/IATTC Overlap Area

High concentration of potential transshipment events in a relatively small area



Note: One nautical mile equals 1.15 miles.

Source: Events from © 2019 OceanMind Limited; includes material © 2016 exactEarth Ltd.; EEZs from MarineRegions.org; and Land and Bathymetry from Natural Earth

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Table 5

WCPFC/IATTC Overlap Area Carrier Vessel Activity

Count of potential high seas transshipment events by vessel flag

Flag State	Distinct carrier vessels	Detected potential transshipment events
Kiribati	1	3
Liberia	3	45
Panama	9	77
South Korea	2	8
Chinese Taipei	2	23
Vanuatu	5	60
Total	22	216

Source: Pew analysis of transshipment activity based on exactEarth AIS data and an OceanMind algorithm

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WCPFC/NPFC overlap area on the high seas off Japan

Figure 14 shows an AIS analysis of potential high seas transshipment events off Japan in 2016 by carrier vessels flagged to WCPFC CCMs. All carrier vessels involved were authorized to transship under both the WCPFC and NPFC management regimes. Carrier vessel movements indicated that nearly 600 potential high seas transshipping events involving 26 vessels occurred in this dually managed region of the North Pacific. (See Table 6.)

These events took place primarily in the third quarter of 2016. The relatively high number of potential transshipments indicates another area, in addition to the WCPFC/IATTC overlap area, where events may not be well documented or reported to either RFMO. The potential for unreported events is exacerbated by the fact that the NPFC does not have a carrier observer management or robust transshipment reporting scheme, and WCPFC carrier observers, as stated above, are not required to submit reports to the WCPFC secretariat when they observe transshipment events on the high seas.³³

Despite documentation of fishing catch and effort in 2016 of WCPFC-managed species by authorized vessels in this portion of its Convention area,³⁴ the WCPFC's annual report on transshipment for 2016³⁵ included no reports of transshipments of these species in the same region in which they were caught. In fact, its annual reports for the three previous years also indicated that no such events took place.³⁶ While it's possible that carrier vessels operating on the high seas off Japan exclusively transshipped NPFC-managed fish, especially given the time of year, it is also possible that the lack of information-sharing protocols prevented the reporting of transshipments that included longline-caught and WCPFC-managed North Pacific albacore, yellowfin, bigeye tuna and swordfish.

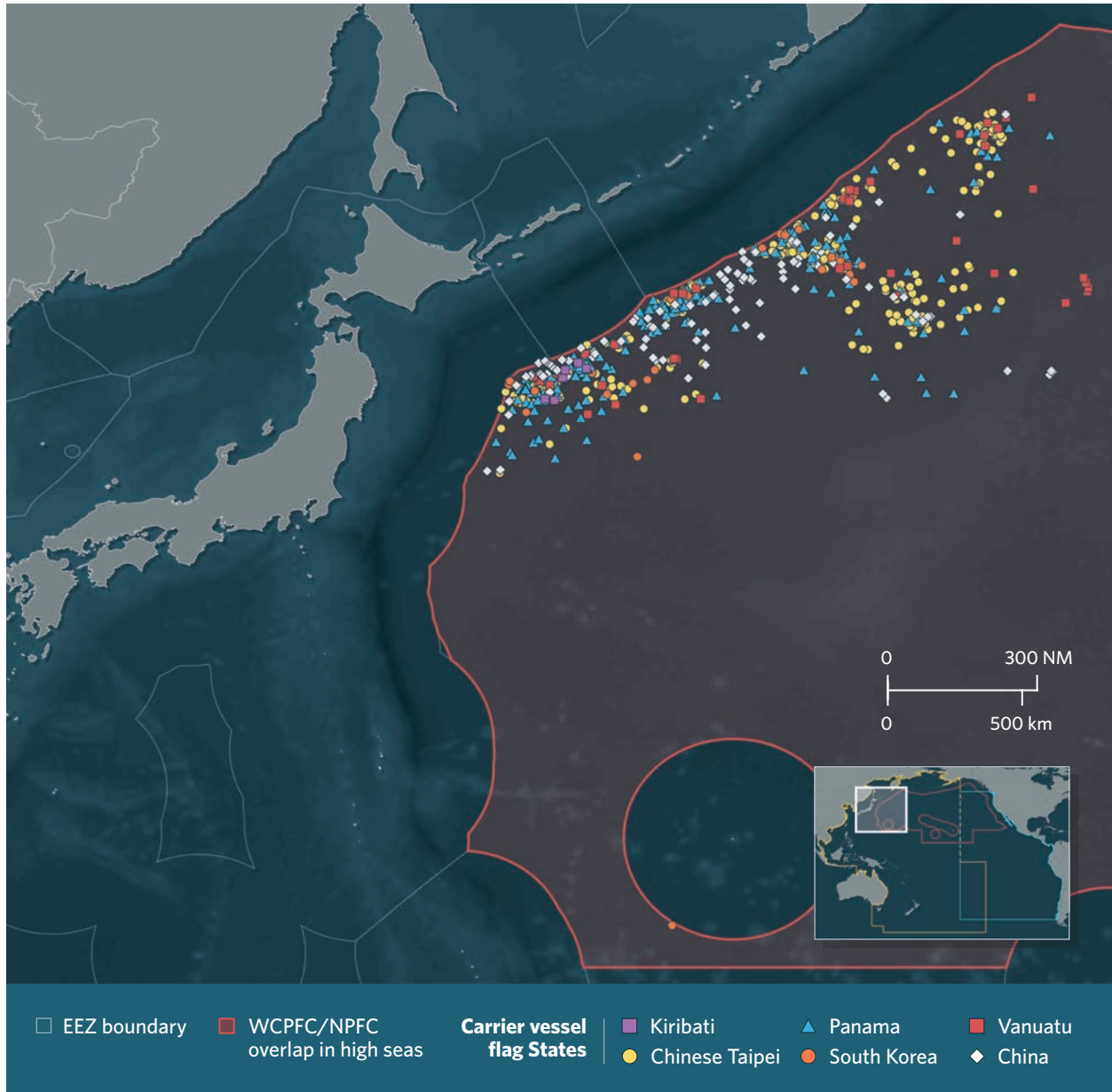
The lack of transshipment notification requirements for carrier vessels in these dually managed waters, coupled with the lack of an information-sharing agreement between the WCPFC and the NPFC, limits both RFMOs' understanding of carrier vessels' transshipments in this region. They lack data on the amount and types of species under their management that are being moved between vessels, and how species are mixed.

Finding: The lack of a data-sharing agreement between the WCPFC and the NPFC increases the risk that transshipments by carrier vessels authorized by both RFMOs may go unreported. This could cause both to inaccurately count species caught in waters they manage, affecting their stock assessments.

Figure 14

Potential Transshipments in WCPFC/NPFC Overlap Area on High Seas off Japan

High concentration of potential transshipment events in relatively small area



Note: One nautical mile equals 1.15 miles.

Source: Events from © 2019 OceanMind Limited; includes material © 2016 exactEarth Ltd.; EEZs from MarineRegions.org; and Land and Bathymetry from Natural Earth

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Table 6

WCPFC/NPFC Overlap Area Carrier Vessel Activity

Potential transshipment events by vessel flag

Flag State	Distinct carrier vessels	Detected potential transshipment events in the high seas off Japan
China	1	25
Panama	15	266
South Korea	1	23
Chinese Taipei	8	252
Vanuatu	1	32
Total	26	598

Source: Pew analysis of transshipment activity based on exactEarth AIS data and an OceanMind algorithm

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Data anomalies

Unreported authorized carrier vessel activity

The Marshall Islands reported in 2016 that a WCPFC-authorized carrier vessel under its flag “did not fish” in the Convention’s waters in 2016.³⁷ However, this vessel was detected on AIS operating in the area and exhibiting movements consistent with high seas transshipment. Eight other authorized carrier vessels—four flagged to China and four to Kiribati—also were observed on AIS exhibiting these movement patterns. None of these nine carrier vessels reported high seas transshipments to the secretariat. And none of the vessels’ three flag States provided information on the vessels in their respective Annual Report Part 1 submissions.³⁸

The carrier vessels could have been operating without observers and without submitting required transshipment declarations and carrying out unreported high seas transshipments. The lack of data on these vessels suggests that the WCPFC needs stronger monitoring and reporting of transshipment activities.

Unauthorized carrier vessel activity on the high seas off Japan

Thirty-five carrier vessels that were not listed as authorized to operate in either WCPFC or NPFC Convention area waters in 2016, based on the Global Fishing Watch list of carrier vessels, were observed on AIS in the North Pacific that year.³⁹ Of these, 22 operated in the overlapping WCPFC/NPFC waters on the high seas off Japan and may have been conducting transshipments. Fourteen of this group were flagged to Russia, four to China, three to Panama and one to the Cook Islands. Figure 15 shows the 2016 tracks of these unauthorized carrier vessels and highlights in yellow the movements of one vessel out to the high seas off Japan, a pattern consistent with transshipment.

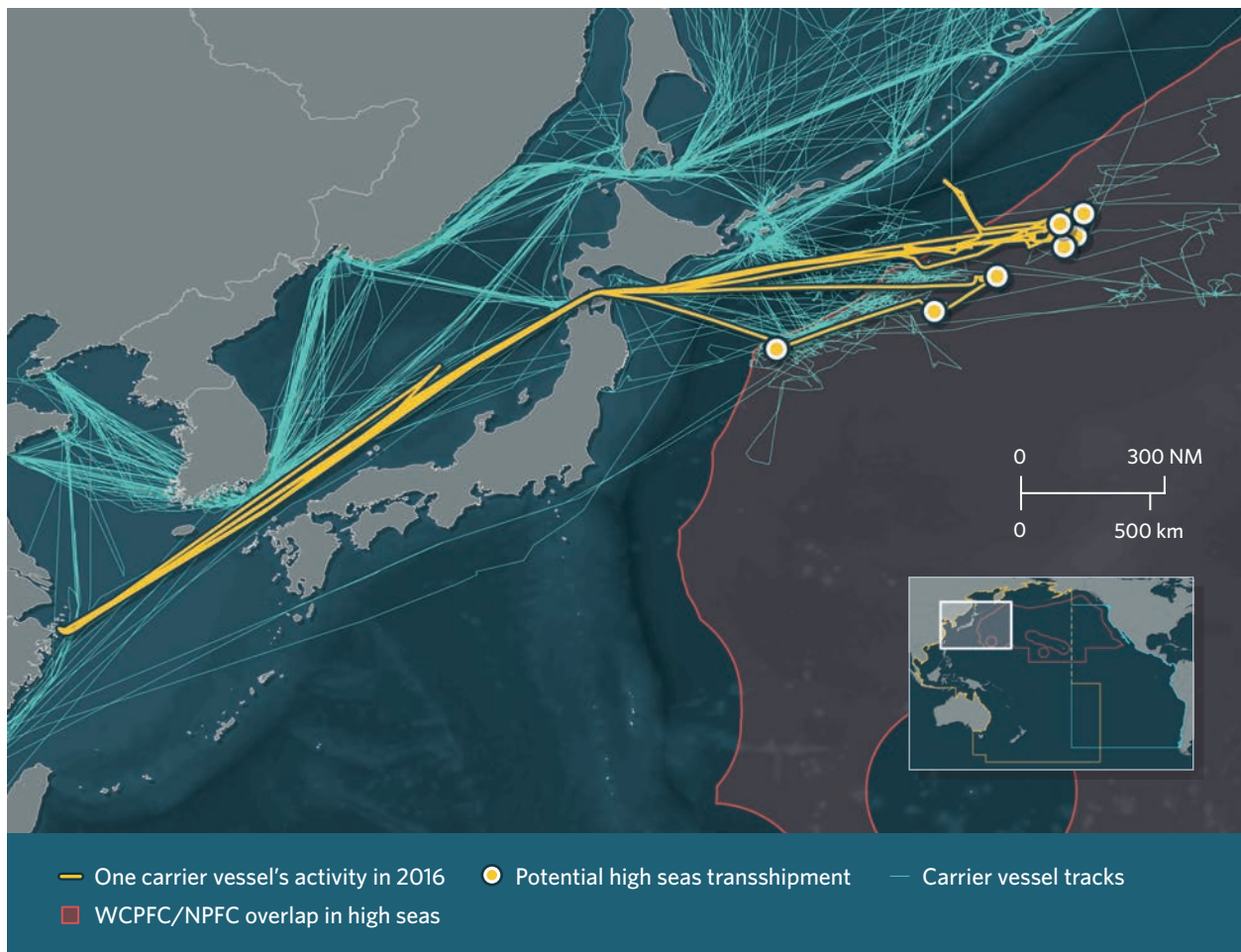
Because these vessels were never authorized to operate by either the WCPFC or the NPFC, it is doubtful that these carriers' transshipment of any species was reported to, and documented by, the relevant RFMO and flag State authority. The activities of these carrier vessels—likely without an embarked carrier observer and proper flag State oversight—suggest that the WCPFC and the NPFC need stronger controls related to carrier vessel authorizations, and monitoring and reporting of transshipment activities.

Finding: Unauthorized carrier vessels probably carried out transshipment activities in WCPFC-managed waters that included, in part, the transfer of WCPFC-managed species.

Figure 15

Activity of 22 Unauthorized Carrier Vessels: Northwest Pacific

One vessel's track shows seven possible high seas transshipments



Note: One nautical mile equals 1.15 miles.

Source: Events from © 2019 OceanMind Limited; includes material © 2016 exactEarth Ltd.; EEZs from MarineRegions.org; and Land and Bathymetry from Natural Earth

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Closer look: Case studies

Carrier vessels that reported high seas transshipment events

For a deeper dive into carrier vessel trends by flag State, Pew created heat maps using AIS data for each of the five fleets that reported high seas transshipments in 2016. These visuals represent carrier vessel traffic density, highlighting where the fleets' movements were concentrated as they operated in the Pacific.

Greater density of vessel tracks does not necessarily imply a higher likelihood that transshipments occurred in that area. However, the heat maps provide a baseline of carrier vessel dynamics within WCPFC waters and give insight into each fleet's movements over time.



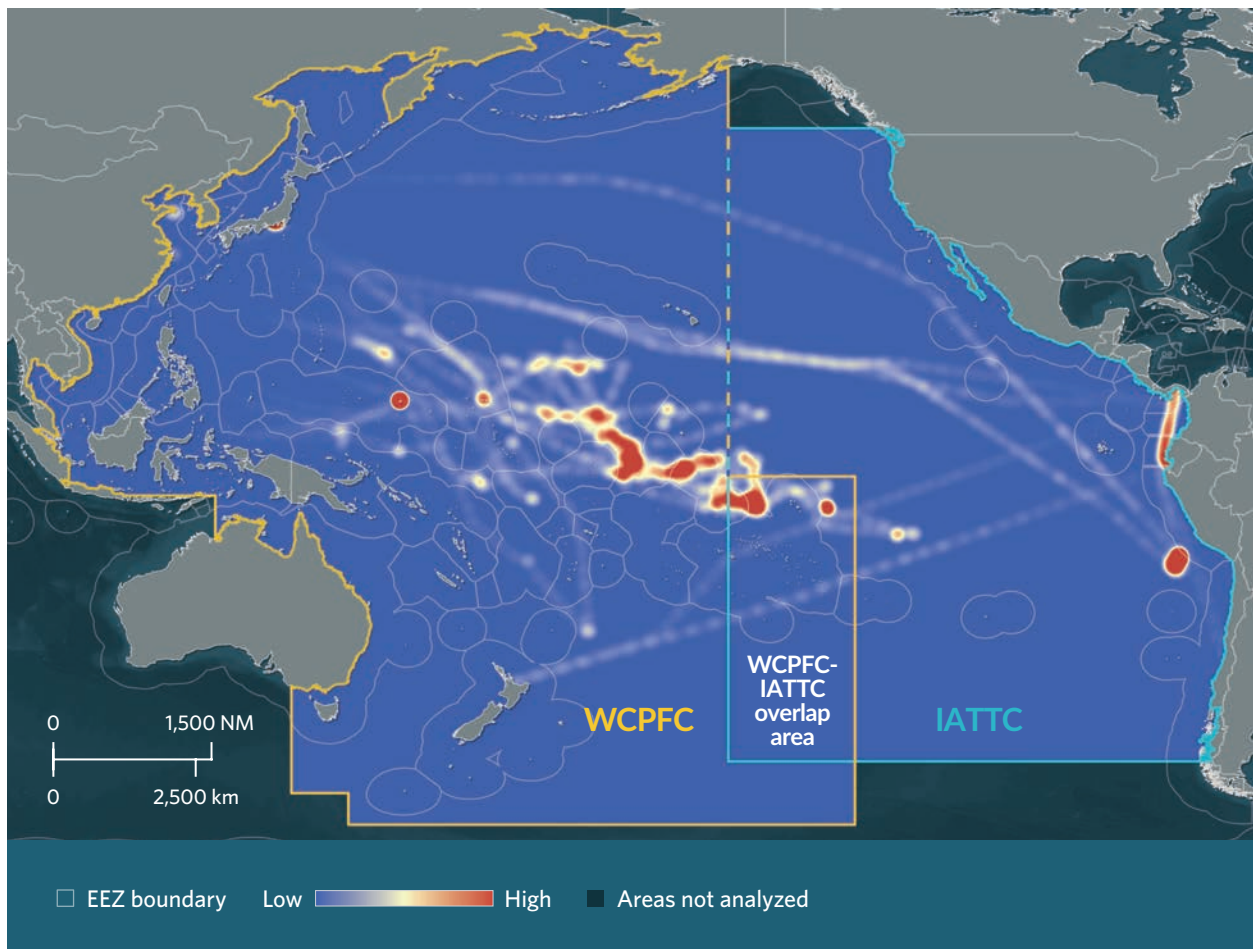
Liberian-flagged carrier vessel activity suggests significant amounts of at-sea transshipment with longline vessel fleets targeting bigeye and yellowfin tuna.

A closer look: Carrier vessels flagged to Liberia

Figure 16 highlights Liberian-flagged carrier vessel fleet dynamics in the Pacific in 2016. Of Liberia's 32 carrier vessels authorized to operate in the WCPFC, AIS data show that three appeared active in the Pacific, two transited only between Asian ports and U.S. ports in Alaska, and 27 were active in other regions of the globe. This heat map appears to show patterns of fleet activity that are concentrated in several high seas locations in the eastern tropical region of the Convention area and the northern section of the WCPFC/IATTC overlap area.

This fleet used more disparate Asian destination ports than the fleet flagged to Chinese Taipei (Table 7). However, this is to be expected given the lack of a genuine, or verifiable, link between these carrier vessels' ownership and the Liberian flag they flew. The three vessels that operated in the Pacific used seven destination ports in 2016 spread among Japan, Chinese Taipei, South Korea, Singapore, and China. These vessels rarely used Pacific ports during the nine voyages the fleet made in WCPFC waters. When they did, they visited only the port of Majuro in the Marshall Islands—and did so four times. Although authorities in the Marshall Islands inspect all vessels that transship while in the port of Majuro, the fleet's infrequent Pacific port visits that year gave port or coastal State authorities in the region few opportunities to inspect the vessels to see if they were complying with regulations.

Figure 16
Liberian-Flagged Carrier Vessel Fleet Traffic Map in the Pacific in 2016
 Areas shown in red indicate concentrations of carrier vessel AIS tracks



Note: One nautical mile equals 1.15 miles. The map shows concentrations of activities by 21 of 32 authorized carrier vessels. The most visited Pacific port was Majuro.

Source: Tracks from © 2019 OceanMind Limited; includes material © 2016 exactEarth Ltd.; EEZs from MarineRegions.org; and Land and Bathymetry from Natural Earth

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Table 7

Ports Liberian-Flagged Carrier Vessels Visited in 2016

Port	Country	Port visits
Shimizu	Japan	30
Singapore (port)	Singapore	24
Kaohsiung	Chinese Taipei	18
Busan	South Korea	14
Yokosuka	Japan	14
Dalian	China	10
Ningbo-Zhoushan	China	7
Qingdao	China	6
Davao	Philippines	5
Majuro	Marshall Islands	4

Source: Pew analysis of transshipment activity based on exactEarth AIS data and an OceanMind algorithm

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As shown in Table 8, three Liberian-flagged carrier vessels reported 193 high seas transshipments to the WCPFC secretariat in 2016⁴⁰—the same number of at-sea transshipping events that Liberia reported in its Annual Report Part 1. Liberian authorities indicated that these events included a combination of high seas transshipments and transshipments that took place in the EEZs of three coastal States, but didn't say how many of each took place.⁴¹ The inability to discern from the reported data where transshipments took place makes it impossible to verify this fleet's activities.

Analysis of AIS data confirmed that three Liberian-flagged carrier vessels operated in the WCPFC Convention area in 2016. Some of the movements of these vessels were consistent with transshipments, indicating that they may have been collectively involved with more than 240 events, with up to 65 in coastal States' EEZs. As Table 8 indicates, the number of possible EEZ and high seas transshipments detected on AIS was higher than the number of such events that Liberia reported in its Annual Report Part 1.⁴²

The European Union (EU) issued Liberia a yellow card on 27 May 2017, identifying it as not cooperating in the fight against IUU fishing,⁴³ a listing that remains in place. The EU took the action in part because it determined that the Liberian government had failed to meet its duties under international law regarding IUU fishing carried out or supported by vessels flying its flag or by its nationals. The designation provided notice that the EU may block access of fisheries products stemming from Liberia to its market unless Liberia fulfilled its obligations as a responsible flag State.

The EU noted that Liberia is a significant flag State, operating the world’s second-largest international registry. It attracts vessels from countries with no direct link to it that operate beyond its EEZ, on the high seas and in other countries’ waters. However, Liberian fisheries authorities do not appear to cooperate—or perhaps lack the capacity to do so—with third countries in all the regions where their flagged fishing vessels operate, except those Liberian-flagged vessels operating in the east Atlantic. This apparent lack of cooperation persists even though Liberia is a member or party to six RFMOs. The EU indicated this problem may be the result of Liberian fisheries authorities’ lack of information about vessels flying their country’s flag but operating outside Liberia’s EEZ because of poor coordination with Liberian Maritime Authority-registered vessels. In addition, while the Liberian Bureau of National Fisheries operates a fisheries monitoring centre to comply with monitoring, control, and surveillance (MCS), the centre monitors only those vessels licensed to operate in the Liberian EEZ. It does not monitor Liberian-flagged vessels operating in the high seas or other countries’ waters.⁴⁴

The EU further indicated that the lack of internal and external coordination and potential unreported transshipments by its flagged vessels suggest that Liberia needs better monitoring and reporting to fully account for its vessels’ activities.

Table 8

Liberia’s Reported Transshipping and Potential Transshipping

Comparison of reported transshipments with potential events detected by AIS

Flag State	Transshipment location	WCPFC carrier vessel-reported transshipping events*	WCPFC flag State-reported transshipping events†	Potential WCPFC transshipping events‡
	EEZ	Not required		65
Liberia	High seas	193	193	178
	Waters outside WCPFC	Not reported		N/A

* Western and Central Pacific Fisheries Commission, Technical and Compliance Committee, “Annual Report on WCPFC Transshipment Reporting, With an Emphasis on High Seas Activities” (2017), 6, <https://www.wcpfc.int/node/29898>.

† Western and Central Pacific Fisheries Commission, “Annual Report to the Commission Part 1: Information on Fisheries, Research, and Statistics—Liberia” (2017), 5, <https://www.wcpfc.int/node/29400>.

‡ Detected from the Oversea Ocean Monitor algorithm and Pew analysis.



Authorities should work to ensure that transshipment activities, such as those depicted above, remain legal and properly reported.

A closer look: Carrier vessels flagged to Panama

Of Panama's 105 carrier vessels authorized to operate in the WCPFC in 2016, 66 were active in the Pacific on AIS, nine transited only between Asian ports and U.S. ports in Alaska, 25 were active in other regions of the globe, and five did not transpond on AIS. Figure 17 highlights Panamanian-flagged carrier vessel fleet dynamics in the Pacific that year. The heat map shows concentrations of vessel movements in the more central portion of the Convention area, primarily in waters that include the EEZs of the Marshall Islands and the Federated States of Micronesia.

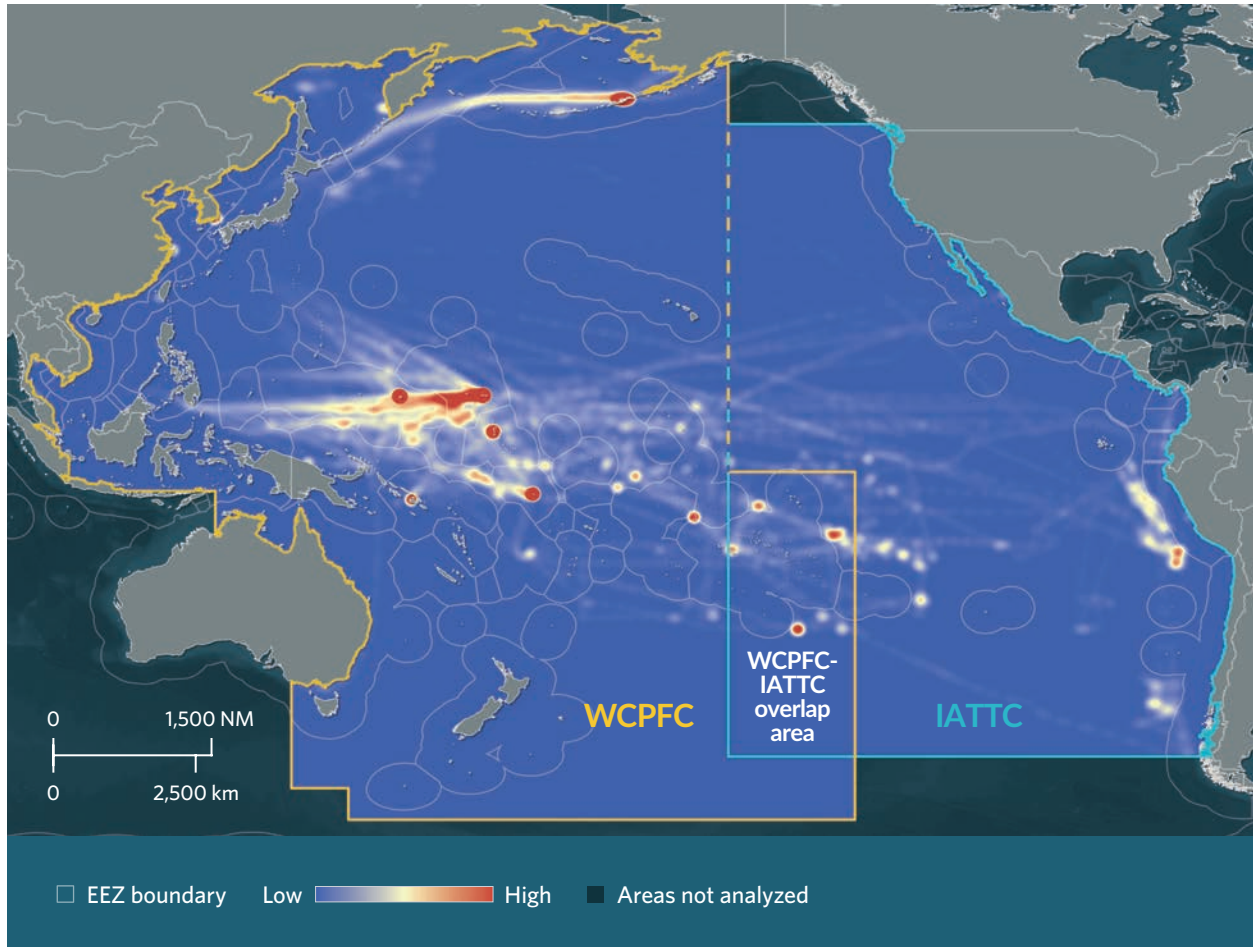
Several pockets of concentrated vessel movements occurred on the high seas and just outside the EEZs of Kiribati, French Polynesia, and the Cook Islands. Of the fleet's 242 voyages in the Pacific in 2016, 59 per cent had vessel movements consistent with transshipments.

Table 9 shows that the Panamanian-flagged carrier vessel fleet was very active in visiting Pacific ports, making 202 calls at four of the ports. All four are locations where transshipments in port are known to take place, indicating that this fleet probably primarily services the purse seine fleet and primarily transships skipjack tuna. Given the high degree of activity at these ports, they represent locations where port State authorities should prioritize inspections to ensure that transshipping activities are legitimate and well documented.

Figure 17

Panamanian-Flagged Carrier Vessel Fleet Traffic Map in the Pacific in 2016

Areas shown in red indicate concentrations of carrier vessel AIS tracks



Note: One nautical mile equals 1.15 miles. The map shows concentrations of activities by 86 of 105 authorized carrier vessels. The most visited Pacific ports were Majuro, Pohnpei, Funafuti, and Tarawa.

Source: Tracks from © 2019 OceanMind Limited; includes material © 2016 exactEarth Ltd.; EEZs from MarineRegions.org; and Land and Bathymetry from Natural Earth

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Table 9

Top 10 WCPFC Ports Panamanian-Flagged Carrier Vessels Visited in 2016

Port	Country	Port visits
Busan	South Korea	125
Bangkok	Thailand	97
Majuro	Marshall Islands	96
Pohnpei	Federated States of Micronesia	56
Ningbo-Zhoushan	China	47
Kaohsiung	Chinese Taipei	46
Dalian	China	40
Funafuti	Tuvalu	29
Yantai	China	24
Tarawa	Kiribati	23

Source: Pew analysis of transshipment activity based on exactEarth AIS data and an OceanMind algorithm

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Nine Panamanian-flagged carrier vessels reported 269 high seas transshipments to the WCPFC secretariat in 2016.⁴⁵ Panamanian authorities provided no information on the country's Annual Report Part 1, but 66 Panamanian-flagged vessels were observed on AIS in Convention waters.⁴⁶

An analysis of AIS data of Panamanian-flagged carrier vessel movements found that as many as 46 carrier vessels may have been involved in more than 880 transshipments at sea. More than 280 of these possible events occurred in several coastal State EEZs. (See Table 10.)

As with Liberia, in November 2012 the EU issued Panama a yellow card identifying it as not cooperating in the fight against IUU fishing.⁴⁷ The EU terminated the card in October 2014, based on improved compliance.⁴⁸ Nonetheless, the vast amount of potential at-sea transshipment activity of this fleet, coupled with a lack of verification of transshipment activities by Panamanian authorities, suggests that the WCPFC needs stronger transshipment monitoring and reporting guidelines.

Table 10

Panama's Reported Transshipping and Potential Transshipping

Comparison of reported transshipments with potential events detected by AIS

Flag State	Transshipment location	WCPFC vessel-reported transshipping events*	WCPFC flag State-reported transshipping events†	Potential WCPFC transshipping events‡
	EEZ	Not required		281
Panama	High seas	269	Not reported	599
	Waters outside WCPFC	Not reported		N/A

* Western and Central Pacific Fisheries Commission, Technical and Compliance Committee, "Annual Report on WCPFC Transshipment Reporting, With an Emphasis on High Seas Activities" (2017), 6, <https://www.wcpfc.int/node/29898>.

† Western and Central Pacific Fisheries Commission, "Annual Report to the Commission Part 1: Information on Fisheries, Research, and Statistics—Panama" (2017), <https://www.wcpfc.int/node/30006>.

‡ Detected from the Oversea Ocean Monitor algorithm and Pew analysis.

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Courtesy of Francisco Blaha

WCPFC regulations require that the purse seine fleet transship its catch only in port unless provided a specific exemption.

A closer look: Carrier vessels flagged to South Korea

Of South Korea's 35 carrier vessels authorized to operate in the WCPFC in 2016, 30 were active in the Pacific on AIS, two operated in other regions, and three were not observed on AIS. Figure 18 highlights South Korean-flagged carrier vessel fleet dynamics in the Pacific in 2016. This heat map shows that South Korean-flagged carrier vessels were particularly active in the central part of the WCPFC Convention area. AIS data indicate several areas of concentrated vessel movements on the high seas and just outside the EEZs of Kiribati, French Polynesia, the Marshall Islands, and the Federated States of Micronesia. Of the 128 voyages by the 30 Pacific carrier vessels observed on AIS in 2016, 66 per cent took place entirely within the Convention area; the remaining were in both WCPFC and IATTC waters.

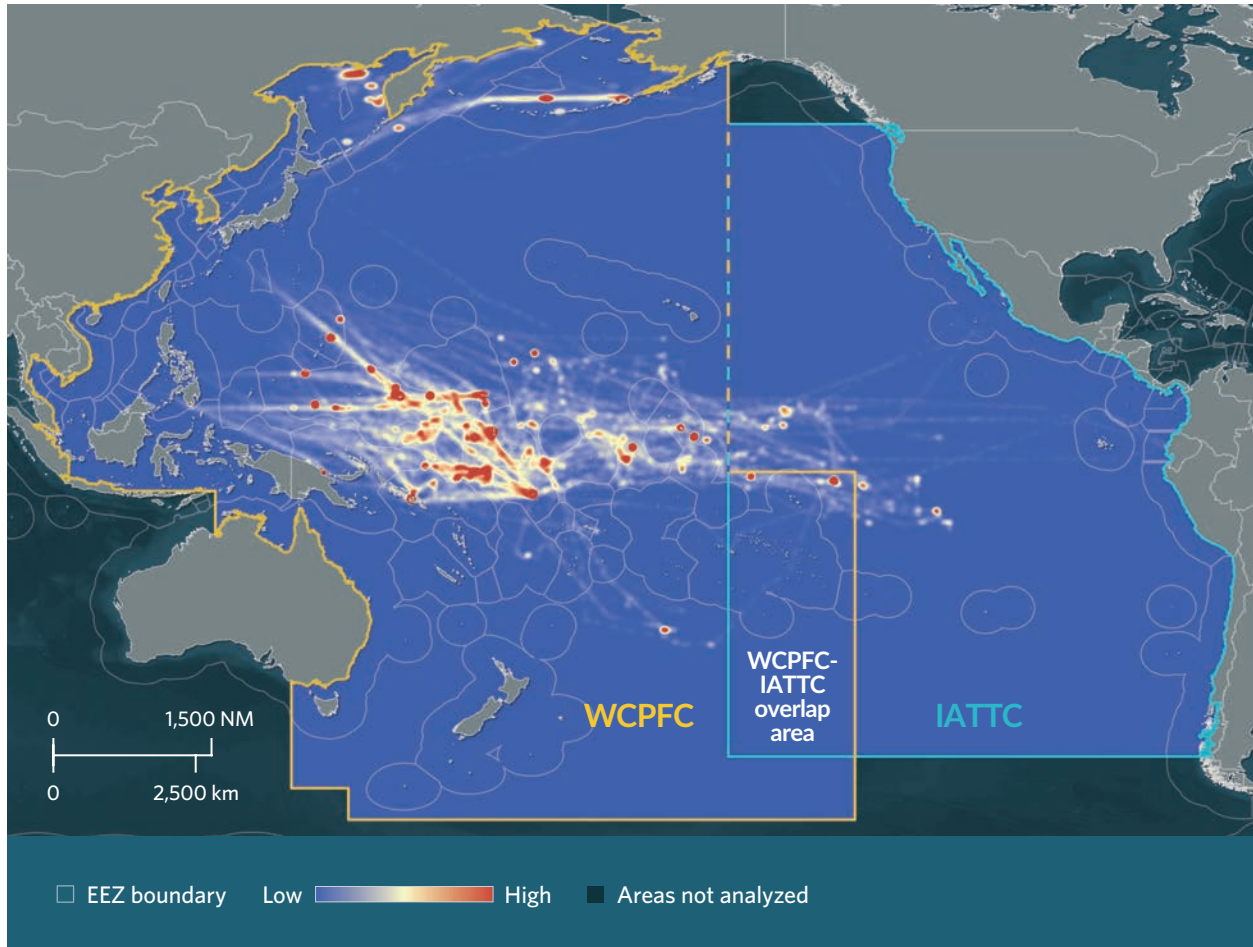
As shown in Table 11, the South Korean-flagged carrier vessel fleet made 167 port calls at six Pacific ports. All six are locations where transshipment in port is known to take place due to the requirement that purse seiners must transship in port. This gives an indication that this fleet is active in servicing the purse seine fleet and primarily the transshipment of skipjack tuna.

As with the Panamanian carrier vessel fleet, the high degree of activity suggests that authorities should prioritize inspections on South Korean-flagged carrier vessels to ensure that their transshipment activities are legitimate and well documented.

Figure 18

South Korean-Flagged Carrier Vessel Fleet Traffic Map in the Pacific in 2016

Areas shown in red indicate concentrations of carrier vessel AIS tracks



Note: One nautical mile equals 1.15 miles. The map shows concentrations of activities by 30 of 35 authorized carrier vessels. The most visited Pacific ports were Tarawa, Honiara, Majuro, Pohnpei, and Funafuti.

Source: Tracks from © 2019 OceanMind Limited; includes material © 2016 exactEarth Ltd.; EEZs from MarineRegions.org; and Land and Bathymetry from Natural Earth

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Table 11

Top 10 WCPFC Ports South Korean-Flagged Carrier Vessels Visited in 2016

Port	Country	Number of port calls
Busan	South Korea	51
Bangkok	Thailand	45
Tarawa	Kiribati	35
Honiara	Solomon Islands	34
Majuro	Marshall Islands	33
Pohnpei	Federated States of Micronesia	29
Funafuti	Tuvalu	23
General Santos	Philippines	14
Rabaul	Papua New Guinea	13
Qingdao	China	10

Source: The Pew Charitable Trusts

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Three South Korean-flagged carrier vessels reported 94 high seas transshipments to the WCPFC secretariat in 2016.⁴⁹ South Korean authorities, however, reported only 79 high seas transshipment events⁵⁰ and did not say how many vessels were involved. The reporting difference and data gap make it hard to verify the information provided by either the carrier vessels or South Korea.

Of the 30 South Korean-flagged carrier vessels observed on AIS, 21 showed movements consistent with potential transshipment at sea. These vessels may have been involved with 413 transshipment events, with over 200 possibly occurring within several states' EEZs. (See Table 12).

The EU issued a yellow card to South Korea, from November 2013⁵¹ to April 2015,⁵² identifying it as not cooperating in the fight against IUU fishing.⁵³ The fleet's high number of potential at-sea transshipments, coupled with the data anomalies between the carriers and the flag State, limited Pew's ability to verify its activities. But the possibility that many transshipments were not reported suggests that the WCPFC needs stronger transshipment monitoring and reporting guidelines.

Table 12

South Korea's Reported Transshipping and Potential Transshipping

Comparison of reported transshipments with potential events detected by AIS

Flag State	Transshipment location	WCPFC vessel-reported transshipping events*	WCPFC flag State-reported transshipping events†	Potential WCPFC transshipping events‡
	EEZ	Not required	21	212
South Korea	High seas	94	79	201
	Waters outside WCPFC	--	16	N/A

* Western and Central Pacific Fisheries Commission, Technical and Compliance Committee, "Annual Report on WCPFC Transshipment Reporting, With an Emphasis on High Seas Activities" (2017), 6, <https://www.wcpfc.int/node/29898>.

† Western and Central Pacific Fisheries Commission, "Annual Report to the Commission Part 1: Information on Fisheries, Research, and Statistics—Republic of Korea" (2017), 16, <https://www.wcpfc.int/node/29444>.

‡ Detected from the Oversea Ocean Monitor algorithm and Pew analysis.

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Transshipped fish are offloaded from a carrier vessel at its first point of landing in Chinese Taipei.

A closer look: Carrier vessels flagged to Chinese Taipei

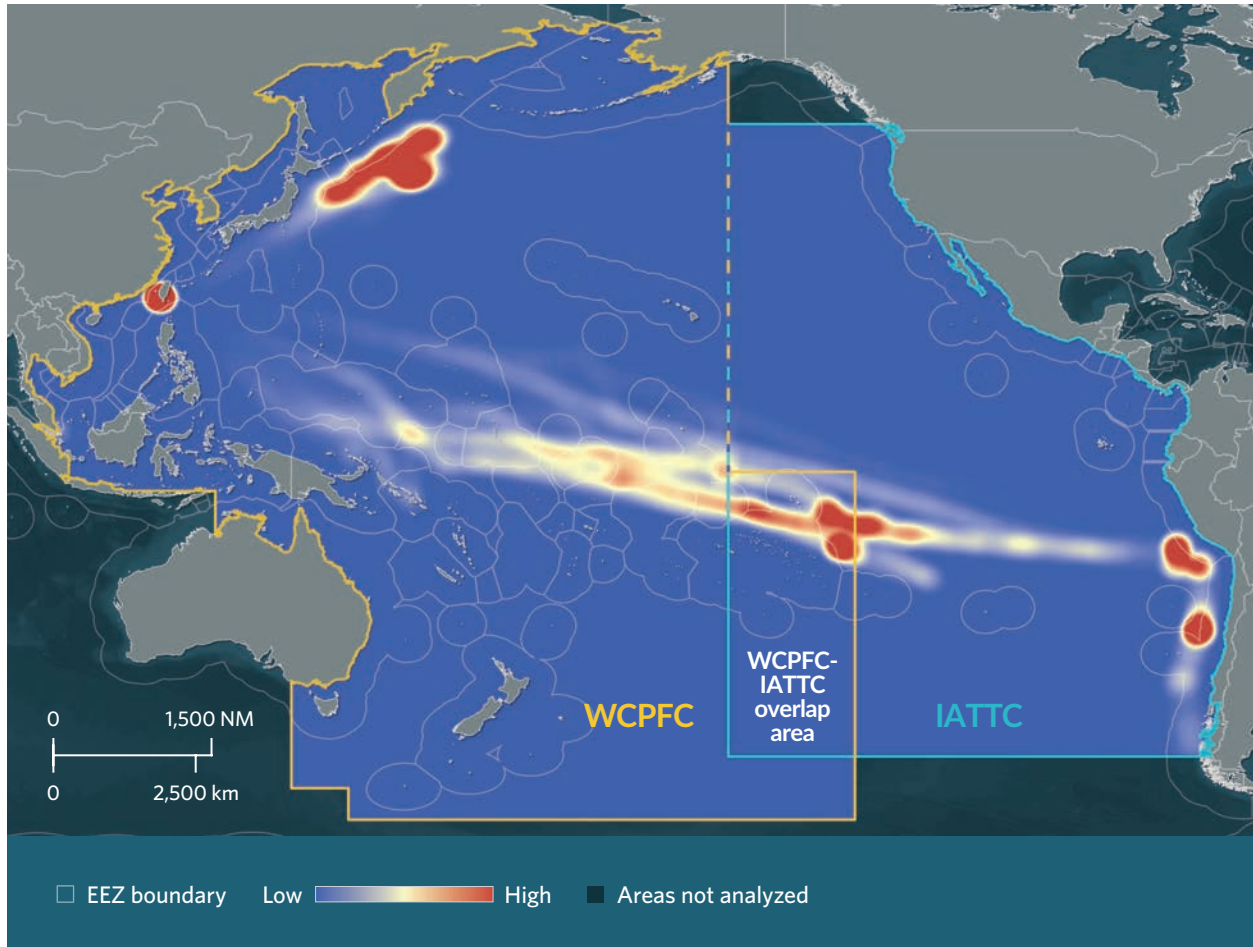
Figure 19 highlights the dynamics of the carrier vessel fleet flagged to Chinese Taipei in the Pacific in 2016. Of Chinese Taipei's 21 carrier vessels authorized to operate in the WCPFC that year, 14 appeared active in the Pacific on AIS, two were active in other regions, and five were not observed to be transponding on AIS. This heat map shows patterns of activity that suggest a high degree of potential transshipments on the high seas, including the western portion of the WCPFC Convention area adjacent to the EEZs of several coastal State CCMs. It is noteworthy that this fleet of carrier vessels rarely made calls in Pacific ports, and more than 64 per cent of its visits were to its destination port, Kaohsiung, Chinese Taipei's primary fishing port. The fleet visited only three Pacific ports: two in the Solomon Islands and one in Papua New Guinea. Although authorities in both locations do inspect carrier vessels arriving in their ports, the rare fleet visits to Pacific ports give limited opportunities for port authorities in the region to inspect vessels (see Table 13). The rare visits also indicate that this fleet relies more heavily on transshipments at sea with longliners rather than with purse seiners, which are required to transship in port, increasing the risk that its vessels engage in unreported transshipment activity.

AIS data also show heavy activity by many of these carrier vessels on the high seas off the coast of Japan, where the WCPFC and NPFC Convention areas overlap, as well as the northern section of the WCPFC/IATTC overlap area. The concentrations of vessel activity in these RFMO overlap areas provide ample opportunities for the vessels to take advantage of inadequate data sharing by RFMOs and reporting shortfalls. Of the 62 voyages that the 14 Chinese Taipei-flagged Pacific carriers made in 2016 that were detected on AIS, 47 per cent involved potential transshipment activity in both WCPFC and IATTC Convention area waters during the same voyage.

Figure 19

Chinese Taipei-Flagged Carrier Vessel Fleet Traffic Map in the Pacific in 2016

Areas shown in red indicate concentrations of carrier vessel AIS tracks



Note: One nautical mile equals 1.15 miles. The map shows concentrations of activities by 16 of 21 authorized carrier vessels. The most visited Pacific ports were Honiara, Kaiveng, and Noro.

Source: Tracks from © 2019 OceanMind Limited; includes material © 2016 exactEarth Ltd.; EEZs from MarineRegions.org; and Land and Bathymetry from Natural Earth

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Table 13

WCPFC Ports Chinese Taipei-Flagged Carrier Vessels Visited in 2016

Port	Country	Port visits
Kaohsiung	Chinese Taipei	68
Singapore (port)	Singapore	17
Dongshan	China	7
Honiara	Solomon Islands	7
Kaiveng	Papua New Guinea	4
Noro	Solomon Islands	2
Fuzhou	China	1

Source: Pew analysis of transshipment activity based on exactEarth AIS data and an OceanMind algorithm

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As shown in Table 14, three Chinese Taipei-flagged carrier vessels reported 113 high seas transshipments to the WCPFC secretariat in 2016.⁵⁴ Analysis of AIS data of the fleet and movements consistent with potential transshipping at sea found that as many as 14 carrier vessels operated in the Pacific, with 11 of the carrier vessels involved with over 300 potential high seas transshipment events. But Chinese Taipei authorities provided no information on the activities of their flagged carrier vessels in their Annual Report Part 1 submission.⁵⁵

The EU issued a yellow card to Chinese Taipei on 1 October 2015, identifying it as a non-cooperating country in the fight against IUU fishing. The EU took the action in part because it determined that vessels flying the Chinese Taipei flag, or its nationals, conducted or supported illegal fishing. Although the EU lifted the designation in June 2019, the card had provided notice to Chinese Taipei that the EU could have blocked access of fisheries products stemming from Chinese Taipei to the EU market unless Chinese Taipei fulfilled its obligations as a responsible flag State.

The EU's initial action indicated that Chinese Taipei lacked an effective MCS system. Chinese Taipei's Fisheries Agency had demonstrated an inability to monitor fishing operations at sea, undermining its ability to enforce RFMO conservation and management measures in different waters. This, combined with the lack of cooperation with other governments' fisheries authorities regarding designated ports and transshipments, enhanced the risk that Chinese Taipei-flagged vessels were conducting IUU fishing.⁵⁶

By lifting the yellow card, the EU indicated it believed Chinese Taipei had taken sufficient action to address IUU fishing. But the probability that vessels under its flag conducted such activities suggests that Chinese Taipei should implement best-practice guidelines for transshipment management—including enhanced monitoring, reporting, and data sharing—to ensure full accountability for this carrier vessel fleet's activities.

Table 14

Chinese Taipei's Reported Transshipping and Potential Transshipping

Comparison of reported transshipments with potential events detected by AIS

Flag State	Transshipment location	WCPFC carrier vessel-reported transshipping events*	WCPFC flag State-reported transshipping events†	Potential WCPFC transshipping events‡
	EEZ	Not required		0
Chinese Taipei	High seas	113	Not reported	310
	Waters outside WCPFC	Not reported		N/A

* Western and Central Pacific Fisheries Commission, Technical and Compliance Committee, "Annual Report on WCPFC Transshipment Reporting, With an Emphasis on High Seas Activities" (2017), <https://www.wcpfc.int/node/29898>.

† Western and Central Pacific Fisheries Commission, "Annual Report to the Commission Part 1: Information on Fisheries, Research, and Statistics—Chinese Taipei" (2017), <https://www.wcpfc.int/node/29446>

‡ Detected from the Oversea Ocean Monitor algorithm and Pew analysis.

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Catch is transferred from a carrier vessel. Although Vanuatu has a relatively small carrier vessel fleet, its collective transshipment activity appears to take place primarily at sea and in waters managed by different RFMOs. As such, these events may require closer management oversight.

A closer look: Carrier vessels flagged to Vanuatu

Of Vanuatu's 22 carrier vessels authorized to operate in the WCPFC in 2016, 13 were active in the Pacific on AIS, five operated in other regions, and four were not observed transponding on AIS. Figure 20 highlights Vanuatuan-flagged carrier vessel fleet dynamics in the Pacific in 2016. This heat map appears to show that Vanuatuan-flagged carrier vessels were particularly active in the eastern part of the Convention area in the Pacific, with traffic movements relatively disparate, much like Liberia's carrier vessel fleet.

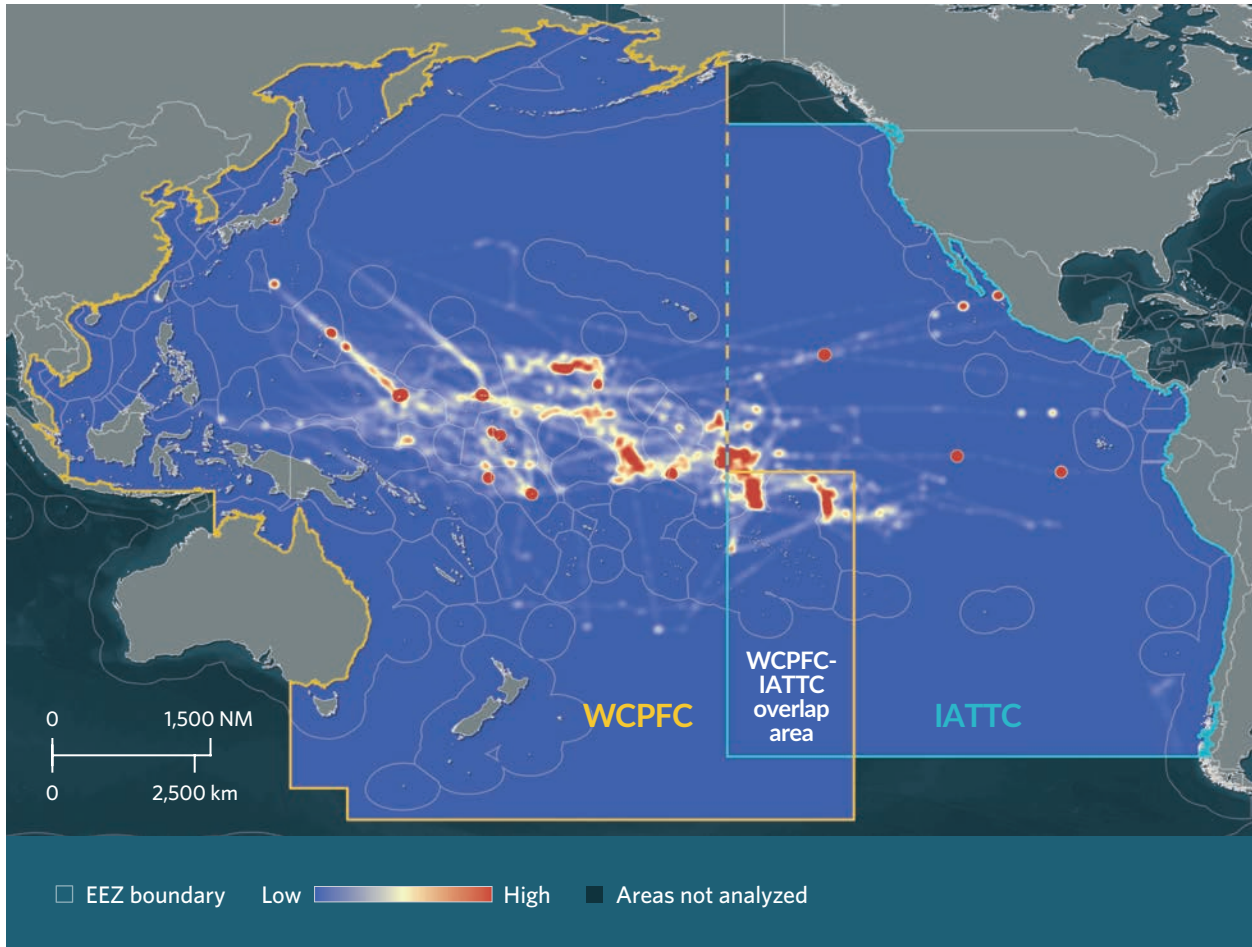
The fleet's activities were concentrated in several high seas locations in the central and eastern part of the WCPFC Convention area and the northern section of the WCPFC/IATTC overlap area. Of the 30 voyages conducted by the 13 Pacific carrier vessels active in the Pacific in 2016 as observed on AIS, 43 per cent took place entirely within the Convention area, with the remaining voyages split between WCPFC and IATTC waters.

As shown in Table 15, the Vanuatuan-flagged carrier vessel fleet appeared to make 29 calls in five Pacific ports in 2016. All five are locations where transshipping in port is known to take place. Much like the vessels flagged to Panama and South Korea, albeit in lower numbers, these carrier vessels' activity indicates that the port State authorities should prioritize inspections in these ports to ensure that transshipment activities by Vanuatuan-flagged vessels are legitimate and well documented.

Figure 20

Vanuatuan-Flagged Carrier Vessel Fleet Traffic Map in the Pacific in 2016

Areas shown in red indicate concentrations of carrier vessel AIS tracks



Note: One nautical mile equals 1.15 miles. The map shows concentrations of activities by 18 of 22 authorized carrier vessels. The most visited Pacific ports were Papeete, Pohnpei, Tarawa, and Majuro.

Source: Tracks from © 2019 OceanMind Limited; includes material © 2016 exactEarth Ltd.; EEZs from MarineRegions.org; and Land and Bathymetry from Natural Earth

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Table 15

Top 10 WCPFC Ports Vanuatuan-Flagged Carrier Vessels Visited in 2016

Port	Country	Port visits
Busan	South Korea	18
Kaohsiung	Chinese Taipei	16
Shimizu	Japan	16
Papeete	French Polynesia	9
Pohnpei	Federated States of Micronesia	6
Tarawa	Kiribati	5
Majuro	Marshall Islands	5
Dalian	China	4
Ningbo-Zhoushan	China	4
Pago Pago	American Samoa	4

Source: Pew analysis of transshipment activity based on exactEarth AIS data and an OceanMind algorithm

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Seven Vanuatuan-flagged carrier vessels reported 279 high seas transshipments to the WCPFC secretariat in 2016.⁵⁷ Vanuatuan authorities, however, stated on their Annual Report Part 1 that 326 high seas transshipment events occurred.⁵⁸ The discrepancy makes it difficult to verify information provided by the vessels or Vanuatu.

Analysis of AIS data of the movements of Vanuatuan-flagged carrier vessels indicated that as many as 11 vessels may have been involved, with up to 234 transshipments, about 42 of which possibly occurred within several States' EEZs.

The EU identified Vanuatu in November 2012 as not cooperating in the fight against IUU fishing⁵⁹ and issued it a yellow card, terminating the card in October 2014.⁶⁰ The fleet's potential at-sea transshipment activity, coupled with the data anomalies reported to the WCPFC, suggests that the WCPFC needs stronger transshipment monitoring and reporting guidelines.

For nearly all the carrier fleets that were observed to have activity on the high seas in the WCPFC in 2016, researchers identified more potential transshipments using this study's methodology than were reported. However, it is noteworthy that for Vanuatu, the number of potential transshipments on the high seas was lower than those reported by its authorities and the vessels themselves. The fact that Vanuatu carriers had fewer events detected than reported suggests that the algorithm used by Overseas Ocean Monitor (OOM) does not just provide a "blanket" overestimation of events based on vessel movements. More refinements may be needed with the transshipment algorithm to improve confidence in the detection of potential at-sea transshipments.

Table 16

Vanuatu's Reported Transshipping and Potential Transshipping

Comparison of reported transshipments with potential events detected by AIS

Flag State	Transshipment location	WCPFC vessel-reported transshipping events*	WCPFC flag State-reported transshipping events†	Potential WCPFC transshipping events‡
	EEZ	Not required	Not reported	42
Vanuatu	High seas	279	326	191
	Waters outside WCPFC	Not reported	Not reported	N/A

* Western and Central Pacific Fisheries Commission, Technical and Compliance Committee, "Annual Report on WCPFC Transshipment Reporting, With an Emphasis on High Seas Activities" (2017), 6, <https://www.wcpfc.int/node/29898>.

† Western and Central Pacific Fisheries Commission, "Annual Report to the Commission Part 1: Information on Fisheries, Research, and Statistics—Vanuatu" (2017), 21, <https://www.wcpfc.int/node/29445>.

‡ Detected from the Oversea Ocean Monitor algorithm and Pew analysis.

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Key findings

This study found that the WCPFC's management of transshipment in its Convention area is compromised by a lack of reported information on transshipment, coupled by non-compliance with reporting requirements and non-standardized reporting responses by CCMs on carrier vessels and their activities. This is exemplified by the following findings related to transshipment monitoring based on analysis of AIS data and publicly available reports:

- At least five times as many carrier vessels operated in WCPFC Convention area waters in 2016 than the 25 vessels that submitted high seas transshipment reports to the secretariat. Very little information is available on the remaining vessels' activities.
- A strong possibility exists that more at-sea transshipments occurred than were reported to the WCPFC by carrier vessels themselves or relevant flag and coastal State authorities.
- Unauthorized carrier vessels probably carried out transshipment activities in WCPFC-managed waters that included, in part, the transfer of WCPFC-managed species.

These findings are reinforced by the following findings related to transshipment reporting and data sharing:

- Data gaps, anomalies, and non-standardized responses by CCMs in their reports on transshipments by carrier vessels provided to the WCPFC impede accurate auditing, increasing the risk that transshipment activities go unreported and unverified.
- The WCPFC "fished/did not fish" reporting metric must be linked to and consistent with VMS data and verified by the WCPFC secretariat to provide any kind of reporting and auditing value.

- Transshipment reporting requirements by the WCPFC, IATTC, and NPFC lack consistency and effectiveness, increasing the likelihood that this activity will not be reported and tracked.
- The absence of a data-sharing agreement between the WCPFC and the IATTC on transshipments by carrier vessels heightens the likelihood that unreported transshipments occur, especially by those operating in the IATTC/WCPFC overlap area or in both Convention areas during the same voyage.
- The lack of a data-sharing agreement between the WCPFC and the NPFC increases the risk that transshipments by carrier vessels authorized by both RFMOs may go unreported. This could cause both to inaccurately count species caught in waters they manage, affecting their stock assessments.

As such, the entire regulatory framework requires significant strengthening, standardization, and harmonization, regardless of whether current reporting requirements are being complied with.

Recommendations

This study identifies several pronounced monitoring and control issues associated with transshipments in the WCPFC Convention area. The Commission should prioritize addressing these findings to ensure that its management of these activities is not compromised. Given the gaps and anomalies in reports by the five fleets that conducted the most transshipments in WCPFC waters and their flag States—and the yellow cards the EU has issued to these States—the Commission should also consider implementing the best-practice guidelines below.

Addressing these findings and implementing the guidelines would also help the WCPFC’s science provider, the Secretariat of the Pacific Community, obtain more complete information on transshipments, which its members could use to improve fisheries management. The Commission should consider placing a ban, or at least a short moratorium, on transshipment at sea in WCPFC waters until it can take these actions.

Best-practice guidelines for transshipment reporting

To make transshipment reporting more complete and uniform, WCPFC and CCM national authorities should:

- Require all transshipments to be reported to the relevant flag State, coastal State, and port State, as well as the WCPFC secretariat, in a standardized format, using IMO numbers as each vessel’s primary identifier.
- Update WCPFC transshipment notification, declaration, and reporting forms to include the type and format of data in standards to be developed by the FAO. At a minimum, the WCPFC should require that reporting include details on the amount and type of by-catch that vessels transship, consistent with the information outlined in Annexes A and C of the FAO’s Port State Measures Agreement.
- Mandate that all WCPFC-authorized carrier vessels intending to transship in the Convention area provide electronic notification of their entry into WCPFC waters to the relevant flag State and the secretariat. That notification should include confirmation of the vessel’s compliance with near-real-time VMS reporting and observer requirements.
- Require that all authorized fishing vessels intending to transship—offloading as well as receiving vessels—submit electronic notifications at least 24 hours beforehand and that they post declarations within 24 hours after the event to the relevant flag State, port State and coastal State, and the RFMO secretariat. They should send the notification before reaching the first point of landing for the catch, regardless of where the transshipment occurred.
- Mandate that observers on board the offloading and receiving vessels submit electronic reporting forms to the relevant flag State, coastal State, and port State, and the RFMO secretariat within 24 hours after each transshipment.

- Task the secretariat to conduct periodic audits of transshipment and carrier vessel activities, including CCM reporting, using a combination of the public and non-public data it holds.

Best-practice guidelines for transshipment monitoring

To make monitoring more effective, WCPFC and relevant CCM national authorities should:

- Require an observer (human, electronic or a combination) on board both the fishing vessel and the carrier vessel for all at-sea transshipments. Also, minimum standards must be set for what information the observer collects.
- Ensure that all carrier vessels authorized to transship in WCPFC waters have access to trained and certified carrier observers from either a national program of CCMs or the Pacific Islands Regional Fisheries Observer program. The WCPFC Regional Observer Program should certify these national carrier observer programs and give them a clear mandate to collect information and data for scientific and compliance purposes.
- Require that all vessels authorized to engage in transshipping activities have an operational VMS on board that relevant flag and coastal State authorities and the secretariat can use to monitor the vessel's movements in near-real time.
- Mandate that carrier vessels have a backup VMS unit in case their primary VMS malfunctions or fails and require that vessels return to port immediately if the primary VMS unit continues to malfunction or has failed.
- Given the complexity of transshipments in the WCPFC Convention area, consider requiring that vessels use AIS as an additional monitoring tool, which would make their activities more transparent and close gaps in overall vessel monitoring.

Best-practice guidelines for transshipment information sharing

To ensure effective data sharing, the WCPFC should:

- Establish and harmonize transshipment data-sharing procedures among relevant flag, coastal and port States with the WCPFC secretariat.
- Revise information-sharing memorandums of understanding between the WCPFC and IATTC secretariats to require the sharing of all transshipment-related information, including declarations and carrier observer reports. The agreement should also allow the IATTC to send the WCPFC secretariat reports from IATTC observers on carrier vessels who witnessed transshipments on the high seas in the WCPFC Convention area involving WCPFC-managed and caught species.
- Establish an information-sharing memorandum of understanding with the NPFC secretariat to require the sharing of all transshipment-related information, including declarations and observer reports, especially when carrier vessels on a single voyage transship species managed by both organizations.

Conclusion

Transshipment of catch between vessels plays an enormous role in the WCPFC tuna fishery. As this study described, the WCPFC authorized 625 carrier vessels in 2016 to transship inside the Convention area. At least 140 carrier vessels—flagged to 11 different CCMs—operated in a manner consistent with taking on tuna and other catch from fishing vessels either in port or at sea. However, only 25 vessels reported this activity on the high seas in Convention waters.

This discrepancy reflects insufficient reporting by carrier vessels, a problem that is exacerbated when data in vessel transshipment reports don't match what is submitted by States. Not only is it likely that more at-sea transshipments occurred that year than authorized vessels or flag States and other CCMs reported to the WCPFC, but unauthorized carrier vessels also probably transshipped in the Convention area, taking on WCPFC-managed species.

This finding, through Pew's review of public WCPFC reports and AIS data, makes clear that the Commission's monitoring of transshipments in its waters is inadequate, especially when they occur at sea. Improving this function of the Commission is critical: Misreporting or non-reporting catches results in the laundering of millions of dollars' worth of illegally caught fish each year.

Enhanced monitoring is also necessary to thwart the illegal activities associated with transshipment, including drug and human trafficking and violations of labour standards for fishing crews. Vessels that transship at sea often stay away from port for months, and their crews have reported substandard working conditions and even slavery.⁶¹

Establishing clear rules for transshipment in the Convention's waters can help ensure a strong, legal, and verifiable seafood supply chain for the species it manages and reduce the likelihood that illicit activities will occur. Likewise, if all WCPFC flag, coastal and port States implement the best-practice guidelines, then all the Convention's stakeholders—including the fishing industry and consumers—can be assured that transshipment is an effective and secure way to transfer fish from the sea to land.

It is hoped this initial study represents just a starting point for making vessel operations in the WCPFC more transparent. With continued research, analysis, and action, the WCPFC could become a model for effective transshipment management for other regions of the globe.

Appendix A: Methodology

Pew carried out this study in part by analysing commercially available AIS data and public information produced by the WCPFC secretariat and its CCMs. Researchers examined AIS-generated carrier vessel tracks to determine if a portion of a vessel's movements were consistent with the slow speeds or loitering that are the hallmarks of a carrier vessel conducting transshipment at sea.

For each carrier observed on AIS, researchers also identified its movements by "voyage"—defined as a vessel's transits at sea from its last port of call in Asia and into the Pacific, and then to its return and next port of call in Asia. For each voyage, Pew counted an "event" as occurring when a carrier vessel's movements were consistent with transshipment at sea.

Researchers identified many ports frequented by carrier vessels—where vessel-to-vessel transshipments are documented to take place—as "Pacific ports."⁶² Transshipments in port take place primarily between carrier vessels and purse seiners but also can involve longliners, albeit much more infrequently. While Pew made no attempt to quantify the number of potential transshipments that took place in Pacific ports, it identified those most frequented as part of the overall carrier vessel trend analysis. These Pacific ports included:

- Marshall Islands: Majuro
- Federated States of Micronesia: Pohnpei, Kosrae
- Kiribati: Tarawa, Kiritimati
- Papua New Guinea: Rabaul, Wewak, Madang, Kokopo, Lae, Kavieng
- Solomon Islands: Honiara, Noro
- Tuvalu: Funafuti
- French Polynesia: Papeete
- Fiji: Suva
- Samoa: Apia
- American Samoa: Pago Pago
- Cook Islands: Avatiu
- Palau: Koror

It identified destination ports, where offloading and processing predominantly take place,⁶³ throughout Asia. These included ports in Brunei, China, Hong Kong, Indonesia, Japan, Singapore, South Korea, Chinese Taipei, Thailand, the Philippines, and Vietnam.

Building the data sets

AIS data

Pew analysed carrier vessel movements in 2016 using AIS data, a type of transceiver that broadcasts information on a vessel's location and identity. AIS technology was originally developed to help prevent vessels within sight of each other from colliding, but the transmissions can also be picked up by satellites and terrestrial receivers. The IMO has mandated the use of AIS for all vessels larger than 300 GT on international voyages,⁶⁴ which includes most refrigerated cargo vessels, or "carriers," listed as authorized vessels on the WCPFC RFV.⁶⁵ For this study, AIS data on a vessel's position and identity from the commercial AIS provider exactEarth was processed using the services of OceanMind and the OOM application, which was developed through a partnership between The Pew Charitable Trusts and Satellite Applications Catapult.

Carrier vessel database—WCPFC RFV

The primary source for building the list of carrier vessels for this study was the RFV, which contains details about vessels authorized to fish in the WCPFC Convention area in waters beyond the national jurisdiction of the Commission member whose flag the vessel is flying. In 2014, the secretariat created an improved web interface for the RFV that allows users to search, filter, and sort public RFV data and view vessel photos. However, the web-based RFV represented only a “live list” of fishing vessels, displaying only those vessels that held a current flag State authorization. This “live” state initially prevented public users from accessing and analysing historical vessel information. Because the scope of this study was carrier vessels authorized during calendar year 2016, the RFV’s live state posed a significant problem. To overcome this challenge, Pew asked the WCPFC secretariat for access to this historical RFV information. The secretariat posed the request to the Commission for its consideration. At its 2017 annual meeting, the Commission agreed that:

- Historical RFV information should be considered part of the RFV and, as such, should be considered “public domain information” in accordance with the WCPFC’s data-access rules and procedures. This includes related fields on fishing/non-fishing and interim lists of non-member carrier and bunker vessels.
- The secretariat would periodically update the full RFV file and make it available for download from the WCPFC’s website until an automated extraction functionality is made available.
- Historical data should not be revised by any party unless arrangements for documenting and verifying the changes are agreed to.⁶⁶

As a result, the secretariat made available on the internet the most recent historical RFV data Excel file. This file contained the following sheets: (a) an export of historical RFV data contained in the secretariat’s databases for the RFV as of 29 August 2017, and (b) an export providing historical information that Commission members reported as to whether their flagged vessels “fished” or “did not fish” in the WCPFC Convention area during a specific calendar year. The file contained information for all authorized fishing vessels from 2009, when the RFV was first created, until August 2017. The secretariat subsequently updated the 2017 RFV with a file dated 24 August 2018 that included the data on authorized vessels added to the RFV after the previous year’s RFV was produced. The 2018 RFV Excel file was considered the “raw data” vessel file for this study.

Master carrier vessel file for 2016

The “master file” Pew created as the baseline database for this study was the listing of all fishing vessels classified as “carrier vessels” by their flag State when they were included on the RFV. To create the first iteration of the file, researchers filtered the RFV raw data file twice: once for a listing of all carrier vessels on the RFV between 2009 and 2017, and again for a listing of all carrier vessels authorized by their flag State in 2016.

The process of verifying some aspects of vessel information in the first iteration of the master file proved challenging. An analysis of the RFV raw data uncovered missing data fields for some of the listed carriers, such as IMO numbers, authorization dates and flag State authorizations to transship at sea. In the end, 609 distinct “fish carriers” flagged to 16 flag States were eventually identified in the RFV raw data file that had authorization dates covering at least some portion of time in calendar year 2016. The master file comprised these 609 carriers and 16 additional authorizations resulting from flag changes, for a total of 625 authorized carrier vessels. Initially, about 60 per cent of the vessels were missing a listed IMO number—a permanent identification number that remains linked to a vessel for its lifetime, regardless of changes in name, flag, or owner. As such, IMO numbers are extremely useful in identifying specific vessels over time.

Additional carrier vessel lists

In addition to the master file, researchers created and used the following two carrier vessel lists as part of this study:

- **Other WCPFC File.** This carrier vessel list included all other carrier vessels that had been included in the 2018 RFV raw data that were authorized at some point by their respective flag States and included on the WCPFC RFV, but this authorization never included 2016.
- **Global Carrier File.** Global Fishing Watch created this list.⁶⁷ It included all other known carrier vessels around the world that had never appeared as authorized vessels on the WCPFC RFV.

Processing and analysis of AIS vessel data

Pew used the OOM application to process the exactEarth AIS data and produce the location/geospatial activity of the carrier vessels identified on the master file. Once processed, researchers found that 244 carrier vessels transponded on AIS in 2016 and operated either in the Pacific and WCPFC Convention area or elsewhere around the globe. A total of 140 vessels, operating under 147 authorizations, were observed on AIS transiting in WCPFC Convention area waters.

For each carrier observed on AIS, Pew also identified its movements by “voyage”—defined as a vessel’s transit at sea from its last port of call in Asia into the Pacific, and then its return and next port of call in Asia. However, not all carrier vessels were in port in Asia on 1 January 2016, nor were all of them stationary in an Asian port on 31 December 2016. This meant that a carrier vessel could have had one or two additional “partial voyages”—spanning before 2016 and/or after that year. For these instances, researchers assumed that the vessel was undertaking an international voyage to conduct transshipping; therefore, these partial trips were each documented as a “voyage.”

For each voyage, researchers counted possible transshipment “events” based on system alerts generated when a carrier vessel’s movements were consistent with transshipment at sea. (The criteria for a transshipment are highlighted in the next section.) Pew further analysed these events to filter out false positives. Researchers did not count or analyse individual events that occurred during voyages outside the WCPFC Convention area.

Researchers also documented specific port calls made by carrier vessels in the western and central Pacific region as well as in Asia, including the duration of each port call. Some carrier vessels’ voyages occurred outside the WCPFC Convention area, except for tracks that indicated direct transits to/from ports in Asia at the beginning and conclusion of the voyage. Likewise, other carriers’ movements were documented on AIS as being entirely outside WCPFC waters. In these cases, researchers documented these voyages as “outside of WCPFC.”

Carrier vessel transshipment behaviour

The OOM application flagged specific points in the AIS-generated vessel data when a carrier vessel’s movements were consistent with the slow speeds or loitering typical of a carrier vessel conducting transshipment at sea. Pew characterized the activity as a possible transshipment if the vessel was located more than 20 nautical miles from shore and exhibited speeds of 2 knots or less for three hours or more (up to no more than 24 hours).

The machine learning algorithm that the OOM application employs uses these metrics, which are based on a review of at-sea transshipments documented by fisheries observers who participated in carrier observer programs developed by the International Commission for the Conservation of Atlantic Tunas and the Indian Ocean Tuna Commission. Observers on carrier vessels operating in these two Convention areas in 2016 documented in their reports the length of time that at-sea transshipments took. In most cases, they reported,

transshipments took about 1 ½ to 2 ½ hours to complete. This represented only the time it took to move a fish product from one vessel to the other—and not other transshipment behaviour such as positioning the vessels and the slow-speed manoeuvring that probably occurs both before and after the event. So Pew researchers added some extra time to account for such movements, arriving at three hours or more.

Because this initial identification was done without the benefit of cross-referencing vessel monitoring system (VMS) or other non-public data held by national or RFMO management authorities, Pew cannot conclusively state that it captured every event involving the transfer of fish product. Some of these identified potential events could have involved transfers strictly of bait, supplies or personnel, while others may have just indicated vessel loitering activity—where a carrier vessel cut its engine power and drifted or operated at significantly slower speeds to conserve fuel while awaiting further orders from the vessel’s owners or charterers.

In addition to identifying possible at-sea transshipment events, researchers also identified port visits by documenting when a carrier vessel became stationary at a port either in the western and central Pacific or in Asia. Regarding port visits in the Pacific, it is likely that transshipment in port took place when the carrier pulled into one of these ports. However, AIS analysis provided no ability to gauge the number of potential transshipments that a carrier may have been involved in during the time frame it remained in port. As such, no attempt was made to count, or otherwise estimate, potential transshipment events that occurred while a carrier remained in a port in the Pacific. Instead, researchers documented only those ports frequented by carrier vessels in the Western and Central Pacific and Asia.

Using the vessel speed/time metric, the OOM application generated an alert for each possible transshipment that occurred during the voyage(s) of each of the 140 carrier vessels operating under 147 flag State authorizations that transited through WCPFC waters. On a first-pass analysis, the application flagged 4,354 possible transshipment events in 2016. Researchers further analysed the events and eliminated them from consideration if:

- OOM generated duplicate alerts for the same possible event.
- OOM generated an alert within 20 nautical miles of a port.
- OOM generated alerts for activity in the EEZs of China, Japan, Russia, and the U.S. EEZ off Alaska (because these regions were beyond the scope of the study).
- OOM alerts were for activity outside the WCPFC Convention area.
- Alerts indicated a significant AIS gap (greater than 24 hours).

A total of 4,151 events remained, which researchers then categorized into three types of carrier vessel activity: (1) possible transshipments on the high seas, (2) possible transshipments in EEZs, and (3) port calls and duration. Of these types, 2,236 possible EEZ and high seas transshipments occurred in the WCPFC Convention area during 2016. An additional 53 transshipments may have occurred in the archipelagic waters of Papua New Guinea and the Marshall Islands, but researchers did not further evaluate or include them in the overall metrics. The maps of transshipment events (Figures 3, 4, 13, and 14) do not include these extra manual filtering steps, resulting in a difference of 58 events.

Data challenges

Maritime Mobile Service Identity numbers

Data challenges extended to matching vessels to a Maritime Mobile Service Identity (MMSI) number, which, like an IMO number, is designed to be unique to a specific vessel. An MMSI is a nine-digit number used to identify a vessel through its use of AIS. An MMSI is programmed into all AIS systems and VHF electronics on a vessel, thereby providing an internationally recognized number to identify and contact a vessel. The vessel's flag State assigns the number, with the first three digits (called Maritime Identification Digits) representing the vessel's flag, and the last six uniquely identifying the vessel. AIS uses an MMSI, not the IMO number, as the primary means of identification, although the IMO number can be included as part of the static AIS information on a vessel and transmitted in addition to the MMSI. An MMSI must be matched to a specific vessel to be able to analyse AIS data and have high confidence in the vessel's identity. Importantly, while IMO numbers are assigned to a specific vessel and remain with it for its lifetime, a vessel may have different MMSIs assigned during its lifetime, especially if it was sold, chartered, or had flag changes. In these cases, management authorities are responsible for ensuring the MMSI is updated to accurately reflect the change in ownership or flag.

Another challenge associated with an MMSI is that vessel owners or operators can manually enter the vessel's MMSI into the message of their AIS transponder. This process leaves room for potential errors—either intentional or accidental. At times, MMSIs have been documented with arbitrary numbering or numbering that is too incomplete to provide useful information about a vessel's identity. This means that throughout the world's oceans, multiple vessels may be simultaneously broadcasting the same MMSI number, making them indistinguishable from one another without closer analysis. This intentional manipulation of an MMSI is often called “spoofing.”

The changing nature of MMSIs, to include spoofing, was an important factor that researchers needed to consider when they analysed AIS-generated vessel tracks. In addition, MMSI is not a required data field for vessels to be included in the WCPFC RFV, and in most cases the number was not entered. To accurately include AIS analysis in this study, MMSIs not only needed to be researched and included with each of the carrier vessels—including in the master file where those vessels had an MMSI assigned—but instances of spoofing or the changing of MMSIs needed to be documented and factored into the development of the master file and resulting AIS analysis.

In the end, researchers included 625 authorized carrier vessels in the master file of carriers authorized to operate in the WCPFC Convention area in 2016; 381 of these either did not have an MMSI assigned or were not observed to be transponding on AIS that year. This left a data set of only 39 per cent of the total number of authorized carrier vessels observable on AIS.

Specific carrier fleets and use of AIS

The number of carrier vessels not having an MMSI assigned or otherwise not transponding on AIS included 98 per cent of those flagged by the Philippines (269 of 274), 86 per cent of those flagged by Japan (61 of 71), and all those flagged by Indonesia (26). If these three fleets were removed from the total number of carrier vessels authorized in 2016, almost 90 per cent of the remaining vessels were found to have an assigned MMSI or were transponding on AIS.

Uncovering the reason for the extremely low AIS coverage of the Philippine, Japanese and Indonesian carrier fleets proved beyond the scope of this study, but one plausible reason may be related to nuances associated with the definition of carrier vessel that these countries use. Most of these fleets' carrier vessels were under 100 GT—more than 200 tons less than the typical large refrigerated cargo vessel. Their size precluded them from being mandated by the IMO to carry AIS or to have IMO numbers associated with them as mandated by the WCPFC. As such, for this study it was impossible to determine any kind of fleet dynamics associated with the Philippine, Japanese and Indonesian-flagged carrier vessels.

Use of AIS as a single-source data set

While AIS data provide a valuable tool for identifying carrier vessel movements and possible at-sea transshipment, it does have several important limitations. The first is that not all carrier vessels authorized to operate in the WCPFC Convention area in 2016 were using AIS. As earlier indicated, only 244 of 625 authorized carrier vessels were documented to be transponding on AIS, resulting in the analysis of vessel movements and activities of only 39 per cent of the entire carrier vessel fleet.

Compounding this issue, many carrier vessels often turned off their AIS transponder for long periods of time throughout the year. During these periods, researchers could not analyse the vessels' activity or location. While AIS track analysis identified periods when a vessel appeared to have deliberately turned off its AIS transponder, this alone does not imply illegal activity. An AIS transponder may not be transmitting due to extreme traffic in the surrounding waters or substandard equipment, or an operator might turn it off because of dangerous conditions (e.g., due to potential piracy in the Sulu and Cebes seas).

Many of the WCPFC-authorized longline vessels operating within the Convention area in 2016 also did not transpond on AIS. With only a subset of carrier vessels transponding on AIS, a complete analysis of two-vessel encounters was not possible. Rather than perform an analysis involving two incomplete data sets, Pew decided to focus its analysis strictly on carrier vessels and their activities.

Non-public domain data

Additional data exist that could support this study and fill in the noted gaps in information, such as data from the WCPFC vessel monitoring system (VMS), observer reports and transshipment declarations. Pew researchers could have used these additional sources to cross-check the assumptions this study made about possible transshipment activity at sea and in port and to confirm the number of transshipments of fish products. Unfortunately, access to these data sets is restricted due to their classification by the WCPFC as non-public domain data. This limited comparative analysis of AIS data to only publicly available information found in the secretariat's annual reports or those submitted by Commission members.

Appendix B

Table 17

Definitions

Term or acronym	Definition
AIS	Automatic identification system
Bunker vessel	A vessel that supplies fuel for use by other vessels, including fishing vessels. The WCPFC considers it a fishing vessel.
Carrier vessel	A refrigerated cargo vessel designed to carry fish or other perishable items in refrigerated holds until delivered to a cold storage facility on arrival at a port. The WCPFC considers it a fishing vessel.
CCM	WCPFC members, cooperating non-members, and territories
CMM	Conservation and management measure
DWFN	Distant water fishing nations
EEZ	Exclusive economic zone
EU	European Union
FAO	Food and Agriculture Organization
Flag of convenience	A country that maintains an open vessel registry without requiring foreign-owned vessels to maintain a genuine link of vessel ownership to the country
FSM	Federated States of Micronesia
IATTC	Inter-American Tropical Tuna Commission
IMO	International Maritime Organization
IUU	Illegal, unreported, and unregulated (referring to fishing)
MCS	Monitoring, control, and surveillance
MMSI	Maritime mobile service identity
NPFC	North Pacific Fisheries Commission
OOM	Oversea Ocean Monitor
RFMO	Regional fisheries management organization

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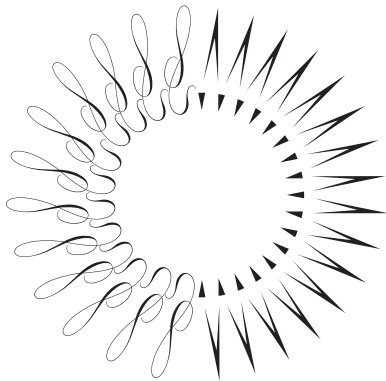
Term or acronym	Definition
RFV	WCPFC Record of Fishing Vessels
Secretariat	The WCPFC Secretariat
Transshipment	The unloading of all or any of the fish onboard a fishing vessel to another fishing vessel either at sea or in port
VMS	Vessel monitoring system
WCPFC or the Commission	Western and Central Pacific Fisheries Commission

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