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A framework to evaluate the economic hardship implications of high-seas transhipment activities in the Western Central Pacific Ocean – Full Study

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A framework to evaluate the economic hardship implications of high-seas transhipment activities in the Western Central Pacific Ocean

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Prepared by the Marshall Islands Marine Resources Authority and Starboard Maritime Intelligence

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1 Executive summary

The WCPFC and the WCPF Convention aim to restrict transhipment at sea. The Conservation and Management Measure (CMM) 2009–06 specifies that longliners and other vessels are not allowed to tranship on the high seas unless "*it is impracticable for certain vessels… to operate without being able to tranship on the high seas"*. Accordingly, WCPFC Members are mandated by CMM 2009–06 to determine if in-port transhipment is impracticable for their relevant vessels and to submit a plan describing the measures being taken to promote transhipment in port.

To establish when transhipment in port is impracticable, the WCPFC has developed a two-part test. First, there must be "significant economic hardship" due to the restriction on high seas transhipment. Second, the ship must alter its historical method of operation in a "significant and substantial" way to comply with the prohibition on transhipment over the high seas. Despite these regulations, CCMs are failing to carry out their responsibilities, and transhipments on the high seas for vessels other than purse seiners have been the norm.

This study was conceived and conducted by the Marshall Islands Marine Resources Authority (MIMRA) and Starboard Maritime Intelligence to support the work of the WCPFC Transhipment Intersessional Working Group on strengthening the policies and regulations associated with high-seas transhipment in the western central Pacific. The work was funded by FFA's Pacific–European Union Marine Partnership Programme (PEUMP).

This study investigates the economic implications of transhipment activity in the WCPFC high seas areas using analysis of vessel tracks reported via the automated identification system (AIS). Based on FFA analysis, we assume that the critical component for economic hardship is based on the cost of fuel, and that fuel consumption is directly correlated to distances travelled. Arguments based on historical operational practices are more complex to scrutinise as they require a largely qualitative analysis of activity records over many years, and we recommend their investigation for future work.

We found 4,666 potential transhipments between carrier and fishing vessels between May 1, 2020 and November 4, 2023 in the WCPFC high seas regions within 20˚ of the equator. Of these, 1,048 lasted longer than five hours and formed the basis of this analysis. They involved 375 longliners and 27 carrier vessels. The fishing and carrier vessels were flagged to Panama, South Korea, China, Taiwan, Japan, and Vanuatu. Our network analysis suggests the existence of distinct relationships between fishing and carrier vessels, with more connections between carriers from the same flag states than between differing flag states. In particular, eight carrier vessels are involved in 73% of all transhipments in our dataset and can, therefore, be considered central to the Western Central Pacific Ocean activity.

Targeted analysis of 50 transhipment events resulted in a generalisation of fishing vessel behaviour into three characteristic journey patterns:

1. Fishing in EEZs of a WCPFC member state, then transhipping on the high seas;
2. Fishing exclusively, or predominantly, on the high seas, but transiting across member states' EEZs and passing suitable ports; and
3. Fishing in remote high seas areas, rarely entering EEZs, and transhipping with passing carrier vessels.

We argue that the impracticability exemption was initially conceived to support vessels historically operating according to the third journey pattern. Our finding of numerous events fitting patterns one and two indicate questionable application of the impracticability exemption for in-port transhipment.

We developed metrics that can be assessed procedurally using computer code to derive general patterns from this dataset that potential policy changes may address. These metrics allow for comparing a vessel's distance to reach the high-seas transhipment location with the shortest distance to a suitable transhipment port. The automated calculation of distances related to fishing and transhipment activities provides several insights that would be hard to gain using manual inspection:

- High-seas transhipments involving vessels that fished in relative proximity to ports in PNG (Rabaul, Port Moresby and Kavieng), the Solomon Islands (Noro), and Tonga (Nukualofa) often travel excessively for transhipment.
- Eleven carrier vessels, including three central carriers, often received fish that could have been offloaded in port with less or equal travel-related expenditure.
- 27 longliner vessels made multiple journeys that were more than twice as expensive to reach a carrier vessel on the high seas compared to travelling from the central fishing area to a transhipment port.

The approach we developed in this work to contribute to assessing the economic implications of transhipment can be applied in practice to individual vessels with a high-seas transhipment event. We present step-by-step instructions for practitioners to determine the distance metrics and recommend that this proposed method be applied by WCPFC member states and evaluated for suitability.

We present this approach as a proof of concept for developing a framework to evaluate the impracticability of high-seas transhipments. We fully expect that feedback based on practitioners' experience and discussions with experts and stakeholders will result in modifications and refinements of the method and interpretation of results.

In summary, our findings suggest repeated port avoidance by many vessels licensed to fish in the waters of some FFA members. This suggests that decisions to favour high-seas transhipment over port calls are made for groups of vessels. If true, this practice would be against the transhipment CMM (CMM 2009–06). This challenges any notion that the WCPFC CCM involved in high-seas transhipment carry out the expected due diligence as mandated by CMM 2009–06 to determine if in-port transhipment is impracticable for a particular vessel.

We note that oversight of high-seas transhipments is addressed in the Indian Ocean Tuna Commission (IOTC), International Convention for the Conservation of Atlantic Tunas (ICCAT), Inter-American Tropical Tuna Commission (IATTC) and to a certain extent, the Secretariat of the Commission for the Conservation of Southern Bluefin Tuna (CCSBT) with independent regional observer programmes. As such, it is recommended that if vessels choose to fish in areas of the high seas that justify the impracticability exemption in terms of economic hardship and historical method of operation, they should operate under an observer programme similar to those their vessels comply with in all other tuna RFMOs or come to tranship at any port in the region.

We recommend that the TS IWG considers our findings in its review of the measure and recommends further revisions to the transhipment CMM to WCPFC21, addressing the issues discussed here.

2 Introduction

When insufficiently monitored, at-sea transhipments[1] of fish contribute to mis- and under-reporting of catch. Transhipments on the high seas, i.e., outside a nation's exclusive economic zone (EEZ), are particularly difficult for authorities to monitor and regulate. The variability in reporting from vessels to flag states and from flag states to the Western and Central Pacific Fisheries Commission (WCPFC) coupled with the lack of an independent high-seas transhipment observer programme, make the high seas longline fishery one of the most significant contributors to IUU fishing in the region primarily through underreporting and misreporting of catch (FFA 2021)[2].

The WCPFC and the WCPF Convention aim to restrict transhipment at sea, and they have set distinct regulations for purse seine and other fishing vessels. Purse seine vessels operating within the WCPFC Convention Area are prohibited explicitly from transhipment at sea (on the high seas, in a WCPFC Member's territorial sea, and in their exclusive economic zone) under the WCPF Convention. Longliners and other vessels are not allowed to tranship on the high seas unless "it is impracticable for certain vessels . . . to operate without being able to tranship on the high seas." (Conservation and Management Measure (CMM) 2009–06). Accordingly, the WCPF Convention merely mandates that Cooperating Non-Members and Participating Territories (CCMs) and WCPFC members "encourage their vessels, to the extent practicable, to conduct transhipment in port".

WCPFC Members are mandated by CMM 2009–06 to determine if in-port transhipment is impracticable for a certain vessel and to submit a plan describing the measures being taken to promote transhipment in port. To establish when transhipment in port is impracticable, the WCPFC has developed a two-part test:

- First, there must be "significant economic hardship" due to the restriction on high seas transhipment. Based on the cost that would be incurred to tranship or land fish at practical and permitted locations other than on the high seas, as compared to total operating costs, net revenues, or some other meaningful measure of costs and/or revenues, the relevant CCM must determine whether transhipment in port causes "*significant economic hardship*."
- Second, the ship must alter its historical method of operation in a way that is "s*ignificant and substantial*" in order to comply with the prohibition on transhipment over the high seas.

Wold (2018)[3] notes that the CMM speaks of "the vessel". The singular "vessel" and the definite article "the" both suggest that the test needs to be conducted on a particular vessel. Thus, the text of the CMM does not grant, in principle, justification to judge impracticability for a fleet, as it considers a vessel-by-vessel analysis. This applies to both economic hardship and historical modes of operation. Vessels have varied transhipping expenses in port, within national waters, or on the high seas, depending on its size, crew composition, fishing location, and other considerations, and a unique history.

As a result, some CCMs are failing to carry out their responsibilities, and transhipments on the high seas for vessels other than purse seiners have been the norm based on historical practices and the prohibitive costs of transhipping in port (WCPFC 2023)[4]. More than 60% of longline and non-purse vessels are registered for transhipment on the high seas. CMM 2009–06 is not effectively reducing transhipment on the high seas. CMM 2009–06 calls on the WCPFC's Executive Director to prepare

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[1] This study follows the WCPFC definition of transhipment: "the unloading of all or any of the fish onboard a fishing vessel to another fishing vessel either at sea or in port" (WCPFC Convention Article 1 (h)).

[2] FFA (2021) The Quantification of Illegal, Unreported and Unregulated Fishing in the Pacific Islands Region – a 2020 Update

[3] The Impracticability Exemption to the WCPFC's Prohibition on Transhipment on the High Seas *WCPFC-TCC14-2018-DP05.* Paper submitted by the RMI to TCC 14 https://www.wcpfc.int/doc/wcpfc-tcc14-2018-dp05/impracticability-exemption-wcpfcs-prohibition-transhipment-high-seas

[4] WCPFC (2023) Annual Report on WCPFC, 2023. Transhipment Reporting https://meetings.wcpfc.int/node/20503

new guidelines for determining the circumstances in which it is “impracticable” for certain vessels to tranship in port or in waters under national jurisdiction.

The Executive Director has proposed new definitions for “impracticability" that consider specific features of the fisheries, but CCMs have rejected these proposals (Wold 2018). Furthermore, the Transhipment Intersessional Working Group (TS IWG) has been working for the last two years but has not concluded due to a lack of consensus. WCPFC20 requested the TS-IWG meet in person for at least a one-day workshop before the Technical and Compliance Committee (TCC) in September 2024 to continue its review of the measure to provide recommendations for further revisions to the transhipment CMM to WCPFC21 planned for December 2024. Until new guidelines are approved, the interim guidelines will be in effect

A multilateral procedure for reducing the number of high-seas transhipments and increasing their oversight is explicit in the wording of CMM 2009–06. A CCM has the freedom to decide when transhipment in a port or in national waters is deemed impracticable. Still, it must notify the Executive Director 36 hours in advance of any transhipment, notify the WCPFC of its procedures for monitoring and verifying transhipments, identify the vessels to which the impracticability exemption applies, and provide the Transhipment Declaration to the Executive Director within 15 days of the transhipment's completion. Additionally, a strategy outlining the measures each CCM is taking to promote transhipment in port must be submitted to the WCPFC.

In 2023, nearly 90% of all known high-seas transhipments were carried out by vessels from China, Chinese Taipei (Taiwan), Korea, and Vanuatu, with the remaining vessels coming from Japan. Given that most longline vessels flagged to Vanuatu are controlled by individuals or entities in China and Chinese Taipei, it's plausible to conclude that these two CCMs are responsible for the largest share of high-seas transhipments. It is thus essential to note that only very few of the 25 WCPFC’s CCMs are involved in high seas transhipment.

Longliners flagged to the European Union, Japan, and the United States fish in the high seas, yet they tranship all (EU and US) or most (Japan) of their high seas catch in port. Many high-seas transhipments take place right outside the exclusive economic zones (EEZs) of coastal state CCMs, indicating that these ships can tranship in port over much shorter distances than longliners from the US, EU, and Japan can, and that they may be moving from national waters to the high seas to evade coastal State CCM monitoring.

It is essential to recognise that arguments of economic components currently do not consider the expenses incurred by carriers. Carriers are de facto part of the transhipment definition and will therefore need to be included in a holistic evaluation of the economics of the tuna longline transhipment economic feasibility. While not a specific objective of this study, a brief analysis and discussion on the “waiting for and transhipment” times of carriers at sea (and such under main propulsion engine power and generators to run the refrigeration systems) in comparison to being anchored at port (with main engines shut down and only refrigeration systems on). To an extent, we analyse the logistics, dynamics, and movements of carriers involved in the HS transhipment and propose that their economics should be part of the impracticability discussions.

We investigated in detail the transhipment activity in the WCPFC high seas areas using ship tracks and vessel details to address the following specific questions:

- What is the spatial distribution of high-seas transhipment activity in the WCPFC?
- What characteristic travelling patterns can inform the argument's validity of economic hardship?
- Who are the central carrier vessels involved in the high-seas transhipments?
- Who are the fishing vessels transhipping with the central carriers?

The main argument for a potential economic burden of in-port transhipment is the extra distance a fishing vessel travels to get to a suitable port instead of transhipping at sea. We test the hypothesis that transhipment at the port is economically not unreasonable. This hypothesis is based on the fact that there are currently 23 ports in the area with infrastructure for transhipment and supplying fishing boats and that the purse seine fleet demonstrates economic viability by transhipping in port while also operating on the high seas.

Based on the findings and learnings from our investigation of transhipment activity, we propose a framework to evaluate claims of potential economic hardship of in-port transhipments based on vessel tracks and their comparative proximity between transhipment ports and at-sea transhipment locations.

This study was conceived and conducted by the Marshall Islands Marine Resources Authority (MIMRA) and Starboard Maritime Intelligence to support the work of the TS IWG on strengthening the policies and regulations associated with high-seas transhipment in the western central Pacific.

3 Methods

3.1 Data source

Ship tracks and vessel identification for this study are derived from the ship's transmissions of the Automatic Identification System (AIS). The operation of AIS transponders is compulsory for all passenger vessels and all large vessels over 500 gross tons, or 300 gross tons, on international voyages (SOLAS 2002[5], IMO 2015[6]). AIS transmissions are received by a network of receivers on shore-based stations, low-Earth orbit satellites, and some commercial vessels, providing practically continuous, global receiver coverage.

Starboard Maritime Intelligence provided ship tracks and ship track-derived events such as transhipments and port call for this study. S&P Global Market Intelligence via Starboard took vessel ownership and company information.

3.2 Transhipment detection algorithm

Likely, transhipment events are determined automatically in Starboard from vessel track data. In some cases, two vessels encounter each other multiple times successively over a few hours or days. The reason for this may be a temporary detachment of the vessels to accommodate crew breaks at night or during bad weather. Starboard merges successive encounters if the gap between them is less than 12 hours and will consider this as a single likely transhipment event.

Based on the experience of our team and observer reports (Brogan 2020)[7], longliners at sea tranship an average of 8 to 10 metric tons of fish per hour. This was measured from the time of the first transfer up until the last, not including the time involved in getting vessels alongside[8]. However, we expect significant variance around the average transfer rate, with weather and crew fatigue being major factors in its variability.

This study only considers events where a fish carrier and a fishing vessel meet for five hours or longer, as measured from the moment they get alongside each other. Shorter encounters are unlikely to reach volumes of fish that economically justify the time and expenditure to reach the carrier and the opportunity cost of not fishing, and they may be related to the exchange of parts, goods, and crew.

Each transhipment event is catalogued, including the following details:

- Event start time;
- Event end time;
- ID of fishing vessel;
- ID of carrier vessel;
- Latitude and longitude at the start of the event;
- Latitude and longitude at the end of the event; and
- Duration of the event.

3.3 Study area and time frame

This study's area of interest is the high seas region in the WCPFC Convention area (Figure 1). Due to the focus on tropical tuna and tuna-like species, we limit our investigation to transhipment events occurring within 20˚ latitude north and south of the equator. Transhipment events occurring

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[5] SOLAS (2002) SOLAS Chapter V, Regulation 19.2. Carriage Requirements for Shipborne Navigational Systems and Equipment. https://www.liscr.com/sites/default/files/SOLAS%20V_Reg19.pdf

[6] Resolution A.1106 (29): Revised guidelines for the onboard operational use of shipborne automatic identification systems (AIS) (International Maritime Organization).

[7] Brogan, D. (2020) Standardised Monitoring Procedures for Longline Transhipments in the WCPFC. SPC

[8] Appendix C provides a detailed and illustrated explanation of the logistics and timeline of at-sea transhipment.

between May 1, 2020, and November 4, 2023, were considered in this study. Ports offering transhipment infrastructure in WCPFC member states considered in this study are shown in Table 1.

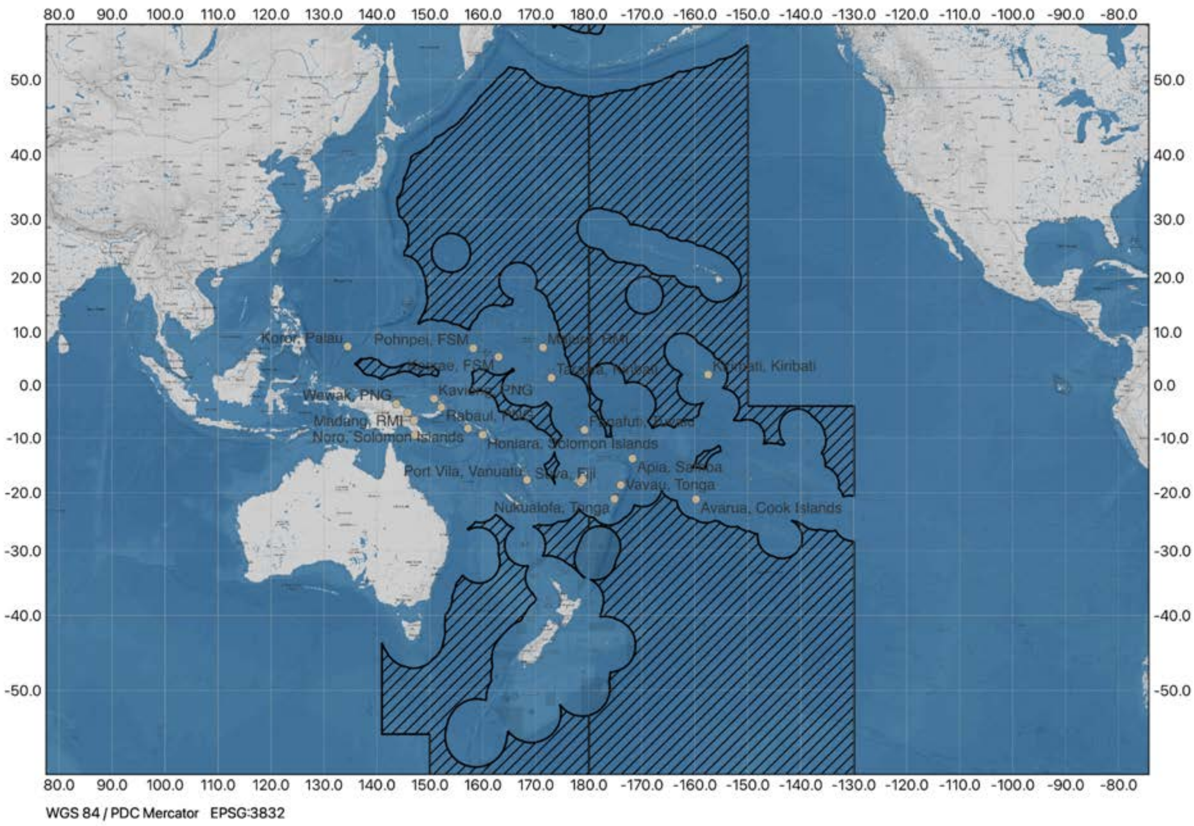


Figure 1: The study area for this work is the high seas region in the WCPFC). Transhipment ports are shown as grey dots with city, country labels.

Table 1: Ports in WCPFC CCMs with suitable transhipment facilities (sorted alphabetically by port city).

Port city (country)	Latitude	Longitude
Apia (Samoa)	-171.76	-13.83
Funafuti (Tuvalu)	179.17	-8.50
Honiara (Solomons)	159.96	-9.43
Kavieng (PNG)	150.79	-2.58
Kiritimati (Kiribati)	-157.47	1.98
Koror (Palau)	134.46	7.33
Kosrae (FSM)	162.95	5.35
Lae (PNG)	146.99	-6.74
Levuka (Fiji)	178.84	-17.68
Madang (PNG)	145.80	-5.22
Majuro (RMI)	171.34	7.10
Moresby (PNG)	147.15	-9.47

Noro (Solomons)	157.20	-8.23
Nukualofa (Tonga)	-175.18	-21.14
Pohnpei (FSM)	158.17	6.97
Port Vila (Vanuatu)	168.31	-17.74
Rabaul (PNG)	152.17	-4.20
Suva (Fiji)	178.42	-18.13
Tarawa (Kiribati)	172.93	1.36
Vavau (Tonga)	-173.98	-18.65
Wewak (PNG)	143.64	-3.57

3.4 Fishing Vessel Journey Characterisation

The main contributor to a potential economic burden of in-port transhipment is the extra distance a fishing vessel travels to get to a suitable port instead of transhipping at sea. Therefore, we aimed to develop a method to reliably quantify the actual distances travelled for certain purposes, such as transit to and from home ports, regional port calls, journeys to and from carrier vessels for transhipment, and transit between fishing grounds.

However, the tracks of longliners active in the WCPFC region are very complicated, and fishing activity is often conducted as the opportunity arises during the transit journeys. Therefore, we first conducted a descriptive expert assessment of a sample of vessel tracks. This analysis has allowed us to generalise three types of journey patterns (Figure 2):

1. Fishing in EEZs of a WCPFC member state, then transhipping in the high seas;
2. Fishing exclusively, or predominantly, in the high seas, but transiting across member states' EEZs and passing suitable ports; and
3. Fishing in remote high seas areas, rarely entering EEZs, and tranships with passing carrier vessels.

The transhipment event characterisation section describes the process of deriving these journey patterns with pertinent track examples.

As this study focuses on developing a framework for evaluating the argument of impracticability, we specifically looked for transhipment events where the fishing vessel appears to avoid going into a port. To detect such potential port avoidance, we looked for vessels showing journey patterns one and two: transhipping in the high seas after fishing inside a member state's EEZ or fishing predominantly in the high seas but transiting across member states' EEZs and passing suitable ports reasonably closely.

Using what we learned from the descriptive assessment, we developed metrics that quantify the distances associated with common activities that can be assessed procedurally using computer code (Table 2).

These metrics include the geographical centre of the fishing area during a fishing period. We defined the fishing period as the time from the last port visit or transhipment event before the current transhipment event. This time frame represents the opportunity to catch fish for offloading during transhipment. The centre of the fishing area during a fishing period is the mean location of all fishing events during that period, weighted by the duration of each fishing event.

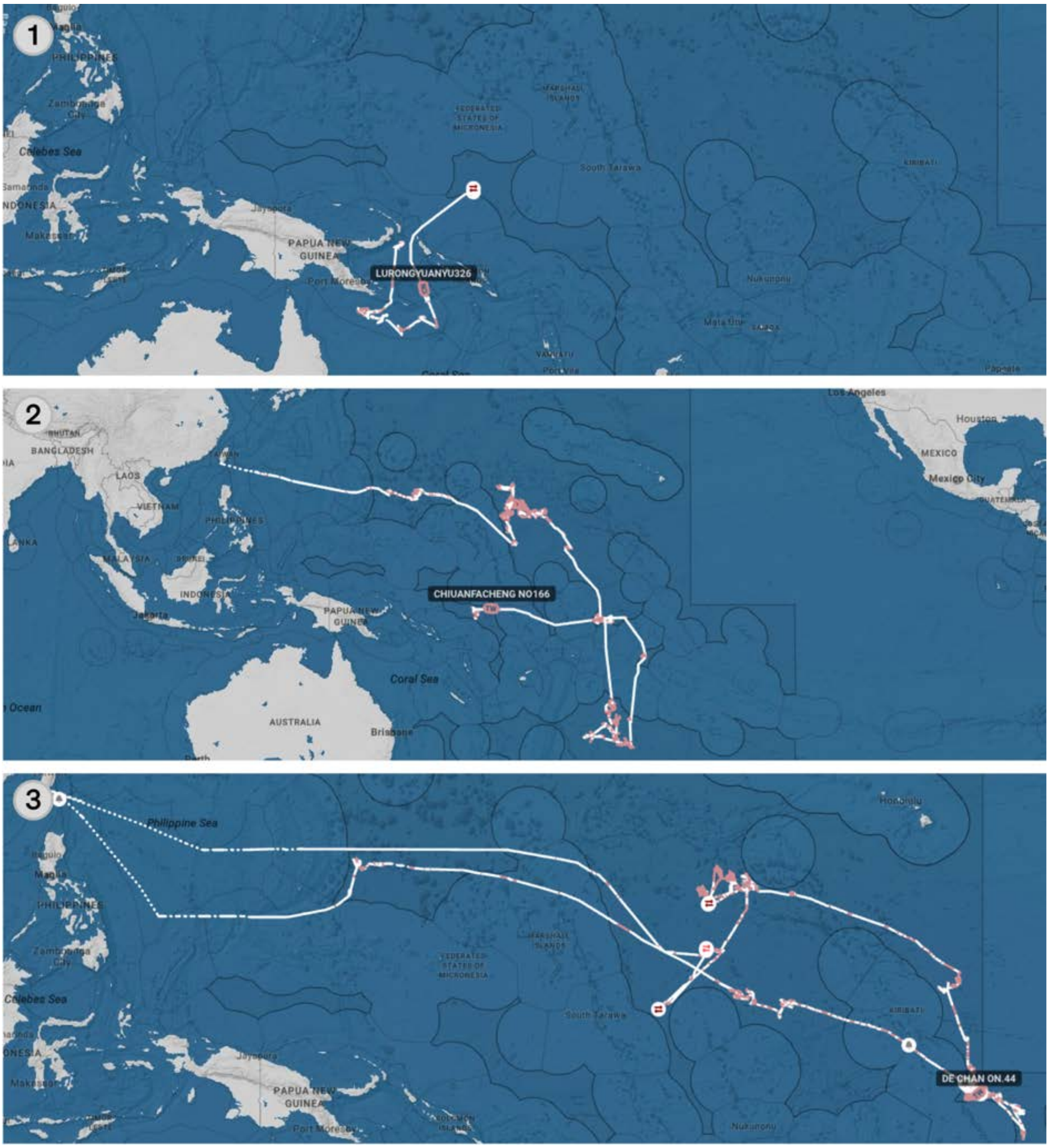


Figure 2: Fishing vessel journey patterns identified in this study. (1) A fishing vessel that operates primarily in the EEZ of a WCPFC member state and transits to a high seas pocket for transhipment (Starboard link). (2) A fishing vessel that operates in the high seas and transits through WCPFC member states' EEZs (Starboard link). (3) Fishing vessels operating in remote high seas areas that rarely enter EEZs (Starboard link).

A fishing event is derived from the geographical centre of a vessel track identified as fishing activity using Starboard's fishing classifier[9]. Because averaging geodesic coordinates, i.e. latitudes and longitudes, is inaccurate over large areas, we convert the location of the centroids to cartesian coordinates before calculating the mean. We use this centre of the fishing area to calculate the great-circle distance (Haversine formula) to the transhipment location. We also calculated the distance to all transhipment ports included in the analysis and then determined the closest port.

[9] https://help.starboard.nz/en/articles/6230281-how-it-works-fishing-classifier-model

The calculation of the shortest distance between the vessel and a transhipment port considers the vessel track two weeks on either side of the transhipment event. We use a subsample of the vessel positions of about 4 points per day. This improves the algorithm's speed without significantly degrading the accuracy of the calculations.

We did this for all transhipment events in our dataset involving fishing vessels on the FFA good standing list[10] and fishing vessels that have transhipped to carriers on that list. We note that this automated approach is experimental at this stage, and we present it as a proof of concept towards developing a framework to evaluate the impracticability of high-seas transhipments.

Table 2: Journey metrics for fishing vessels transhipping in the high seas

Metric	Definition
Distance to high-seas transhipment	Distance from the centre of the fishing area* to the location of transhipment.
Distance to nearest transhipment port	Distance from the centre of the fishing area* to the nearest transhipment port.
Closest approach to transhipment port	Shortest distance from the vessel track to a transhipment port during two weeks after or before the transhipment event.

**see text for definition*

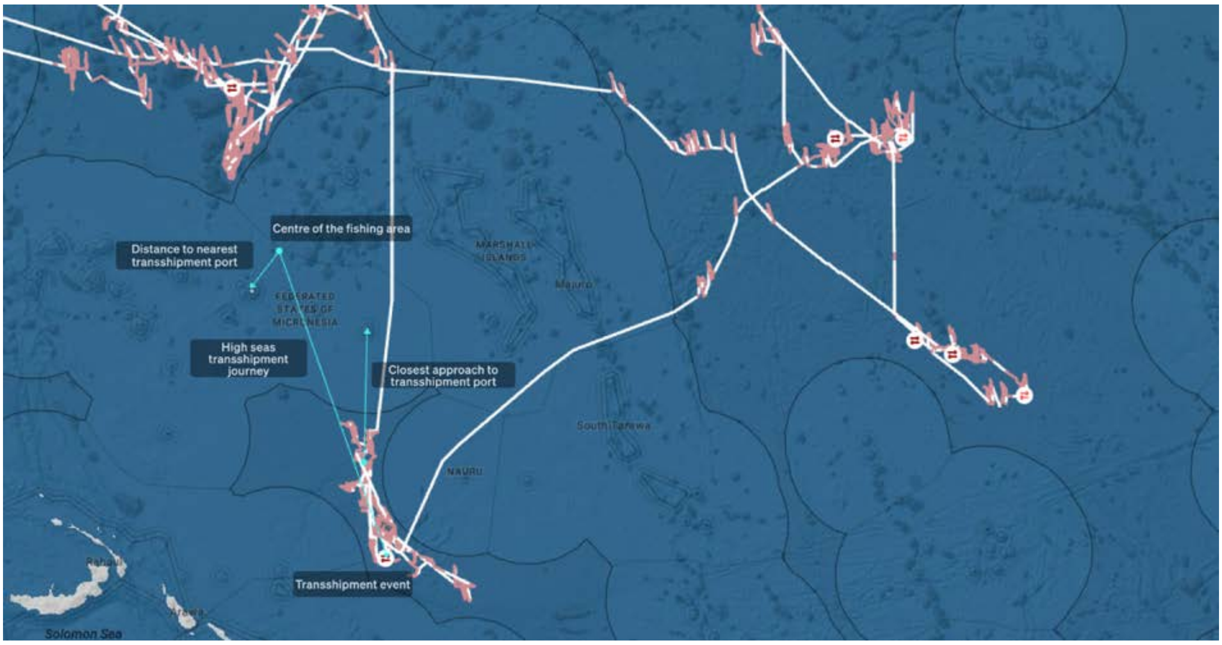


Figure 3: Illustration of the journey metrics for an example of a transhipment event.

3.5 Network analysis

Using our dataset described above, we built a network of transhipments between carriers and fishing vessels. In this network, the strength of the association between a carrier and a fishing vessel is related to the number of transhipment events between them.

[10] https://vessel-register.ffa.int/

The network visualisation is provided as an HTML file (Attachment: transhipment_network.html), which can be opened in a web browser by dragging it into the browser window or using the 'File → Open File…' menu.

The visualisation places vessels that are more strongly associated with one another. This allows us to visualise the most prolific central carriers and the clusters of vessels around them and indirect links between carrier vessels through fishing vessels that tranship with more than one carrier. The network visualisation uses different colours for vessels on the FFA good standing list and those not on it.

4 Results

4.1 High seas transhipment events

Vessel tracks in the study area between May 1, 2020, and November 4, 2023, were analysed to determine transhipment events. A total of 4,666 carrier-fishing vessel encounters lasting longer than one hour were identified in that period in the high seas regions within 20˚ of the equator.

The histogram of encounter duration (Figure 4) shows that shorter encounters are more numerous, and there is a marked reduction in the number of events going from 4 to 5 hours. This supports our choice of the five-hour threshold for significant transhipment activities. The 1,048 transhipment events lasting five hours or longer are considered in this study. The geographical distribution of these events is shown in Figure 5.

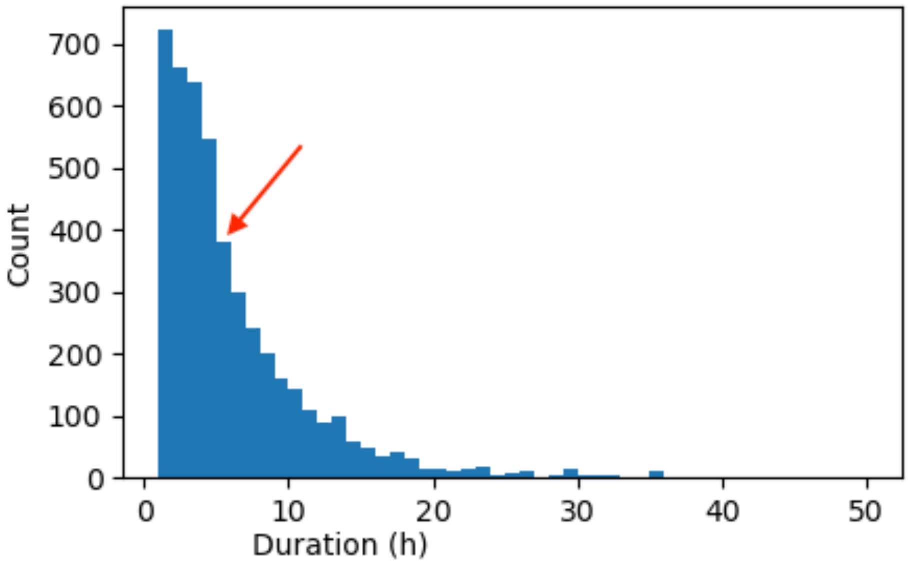


Figure 4: The number of transhipments in the high seas areas of the WCPFC convention area between 20˚ N and S of the equator by duration. The red arrow marks the bar for five-hour-long transhipments. The cumulative number of transhipment events lasting five hours or longer is 1,048.

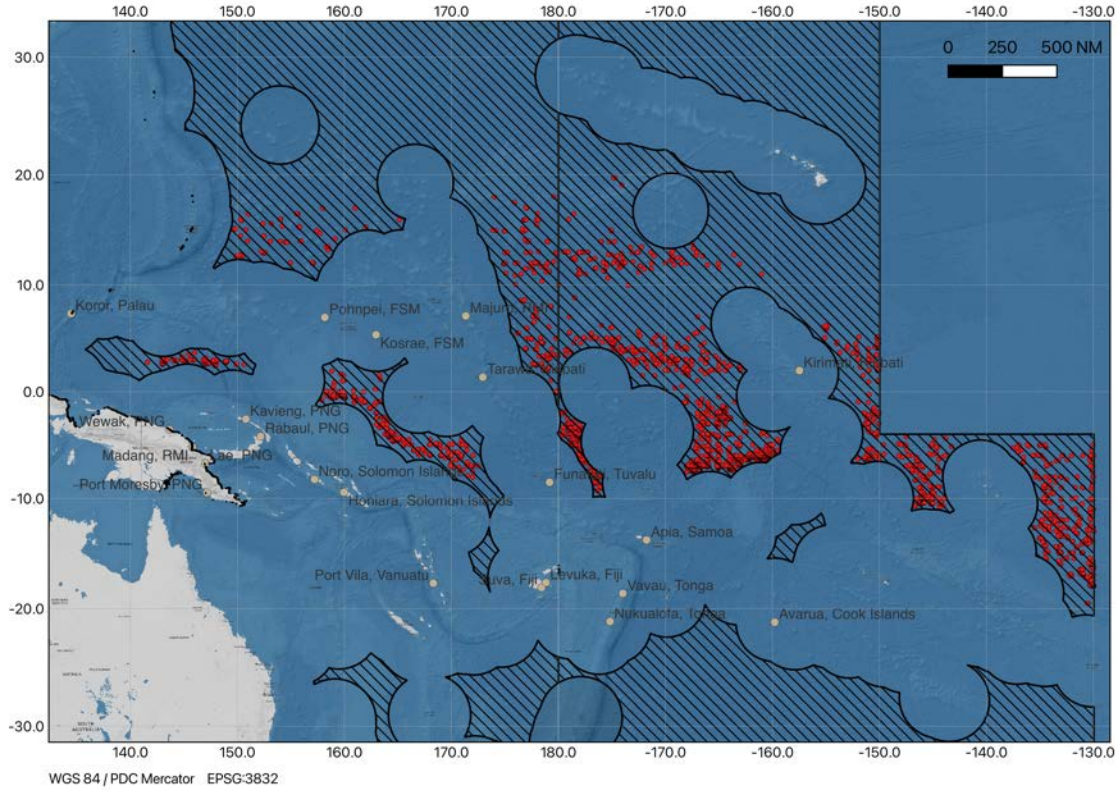


Figure 5: Transhipment events in the high seas areas of the WCPFC convention area between 20˚ N and S of the equator. Transhipment ports are shown as grey dots with city, country labels.

4.1.1 Description of vessels involved in high-seas transhipments

The 1,048 transhipments identified in our dataset were carried out by 375 longliners meeting with 27 carrier vessels (Table 3). The complete lists of fishing and carrier vessels involved are provided in Appendix A and B, respectively.

Inspecting the number of transhipment events per individual carrier vessel, there is a limited number of highly active vessels operating in the region (Figure 6). Two carrier vessels, the Taiho Maru and the Full Kuo Shin 8, have over 100 transhipment events each, and the eight most active vessels are responsible for over 73% of all high-seas transhipments in our dataset.

The carrier vessels are flagged to five nations (in the order of number of flagged vessels): Panama, South Korea, China, Taiwan, and Vanuatu. The Panama-flagged vessels have beneficial ownership in Japan, South Korea, China, or Taiwan, except the carrier vessel Angara. This vessel has a complicated corporate structure with a registered owner, beneficial owner, operator and ship manager from a list of countries, including Malta, Vanuatu, Germany, and Singapore. The Angara has three transhipment events in our dataset with China-flagged vessels.

Two fishing vessels had nine transhipment events, the most significant events in the area and period considered in this study (Figure 7). These two vessels are not currently on the FFA good standing list. Their journey pattern is characterised by fishing exclusively on the high seas and staying well away from EEZ boundaries. Transits between fishing areas are efficiently navigated.

Approximately 60% of fishing vessels had three or fewer high-seas transhipment events, and 129 fishing vessels only had one event. The fishing vessels found in our study are flagged to a similar set of states (in the order of the number of flagged vessels): Taiwan, China, South Korea, Japan, and Vanuatu (Table 3).

Table 3: Dataset Overview

Number of fishing vessels	375
Number of carrier vessels	27
Number of high-seas transhipment events	1,048
Carrier vessel flag states (number of vessels)	Panama (11) South Korea (7) China (4) Taiwan (4) Vanuatu (1)
Fishing vessel flag states (number of vessels)	Taiwan (155) China (104) South Korea (92) Japan (3) Vanuatu (21)

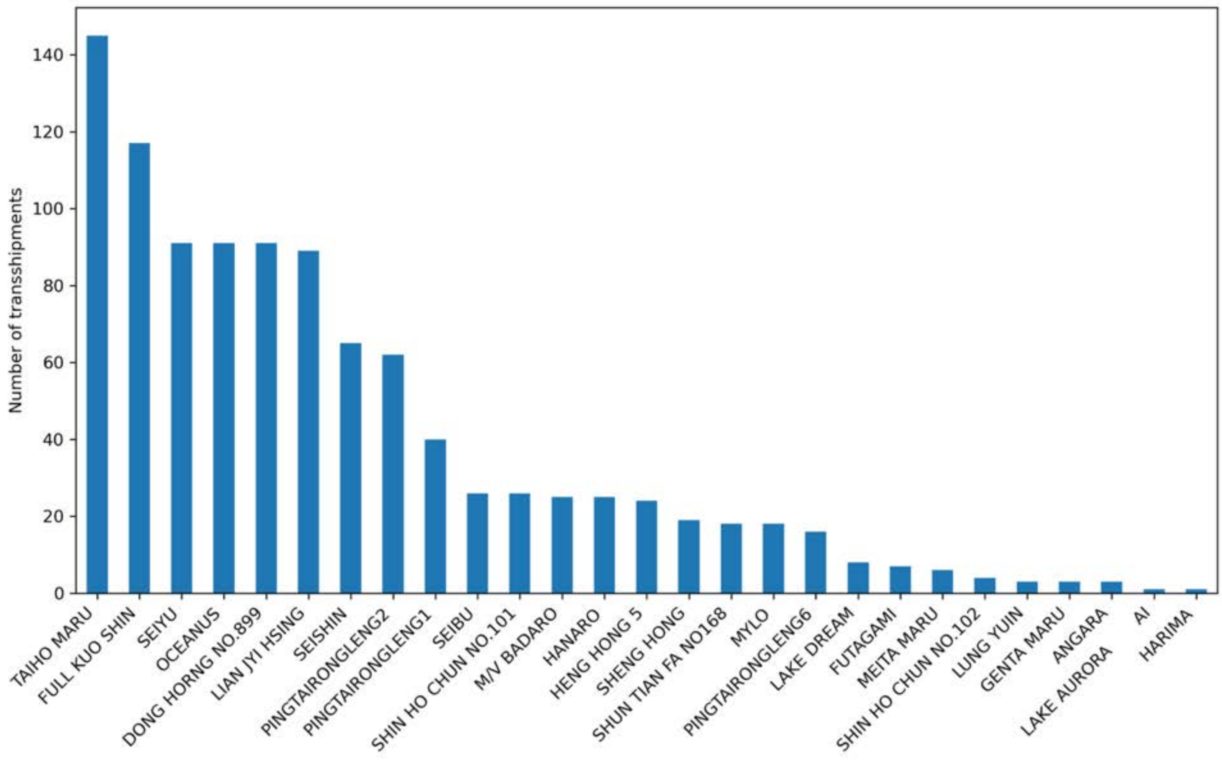


Figure 6: Number of high-seas transhipments by carrier vessel

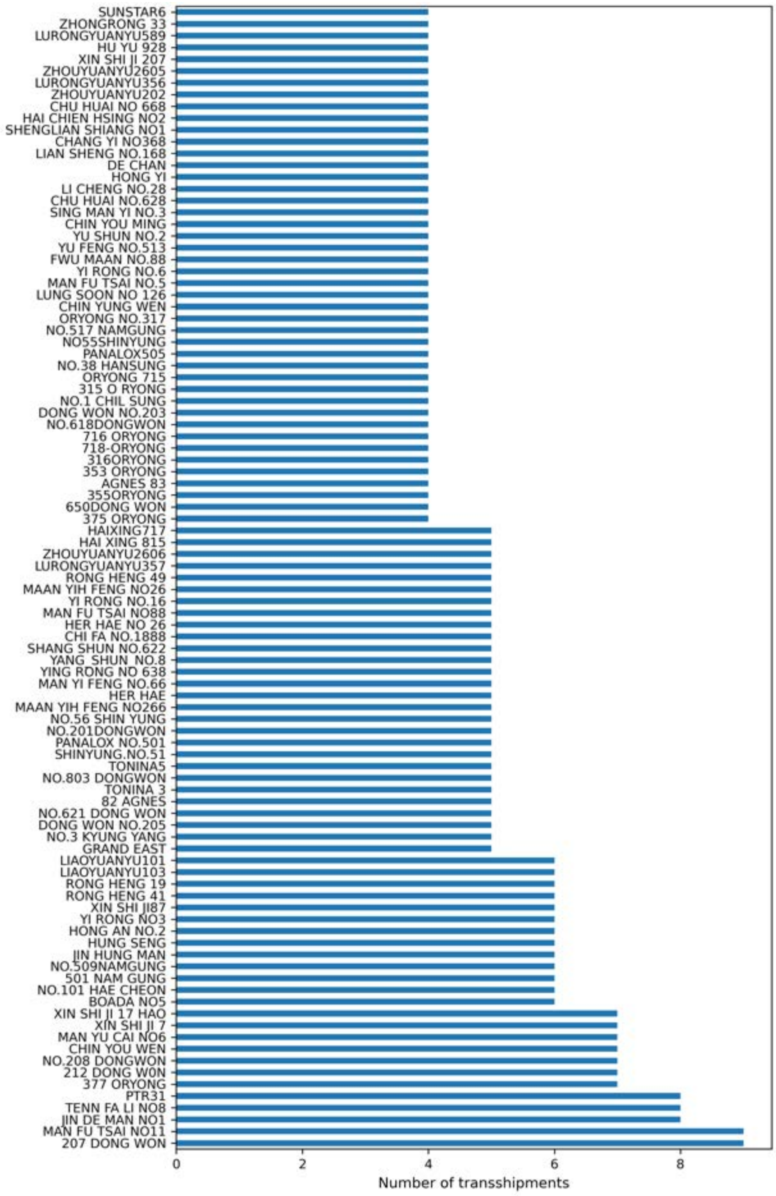


Figure 7: Number of transhipment events for fishing vessels with four or more transhipments

4.2 Central carriers

Eight carrier vessels in our dataset conduct over 73% of all high-seas transhipments. These are flagged to Panama, South Korea, China, and Taiwan (Table 4). The two most active vessels, Taiho Maru and Full Kuo Shin, are flagged to Panama, and their beneficial owners are registered in Japan and Taiwan.

4.2.1 <u>Taiho Maru</u>

The Taiho Maru is a fish carrier flying the Panamanian flag. Its registered owner is Princess Line SA of Panama, and its beneficial owner is Hayama Senpaku KK of Japan. Over the study period, the Taiho Maru travelled between ports in southeast Asia (Japan, South Korea and China) and the high seas areas in the WCPFC, where transhipments are conducted (Figure 8). The vessel's pattern of life is characterised by 55 to 70-day long journeys to the high seas areas of the WCPFC. Transhipments occur mainly in the high seas pocket north of the Solomon Islands and Vanuatu (high seas pocket 2) and the high seas tongues between Tuvalu, Kiribati and French Polynesia. Some activity occurs in the western part of the IATTC convention area. Upon each return from the high seas to southeast Asia, the Taiho Maru visits the ports in Korea and China, including Taiwan, and several Japanese ports.

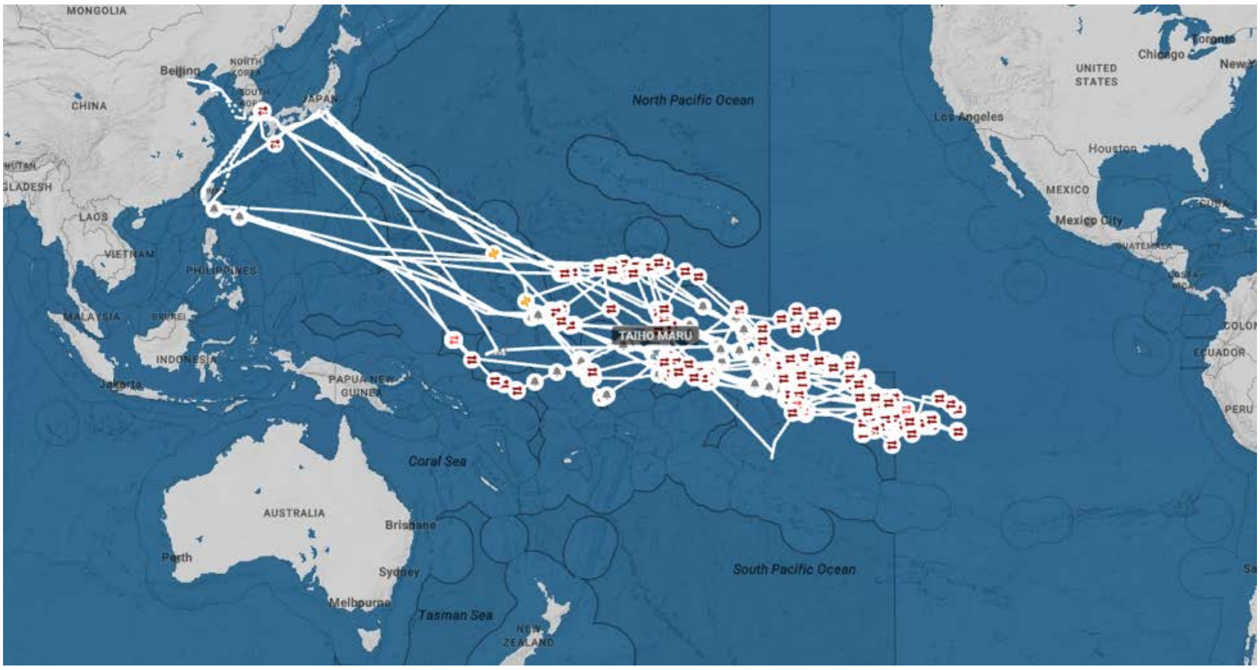


Figure 8: Vessel track of the Taiho Maru from 1 May 2020 to 4 November 2023. The symbol with the double red arrows identifies transhipment events. The high seas regions of the WCPFC Convention area are shaded grey.

4.2.2 Full Kuo Shin

The Full Kuo Shin is a fish carrier flagged to Panama, with the owner, operator and ship manager listed as Full Kuo Corp registered in Taiwan.

Over the study period, the vessel's vast majority of port calls were at Kaohsiung, Taiwan, after uninterrupted 60 to 100 days at sea in the WCPFC high seas areas (Figure 9). The vessel had two port visits in the Philippines in May and September 2022 before continuing to the high seas.

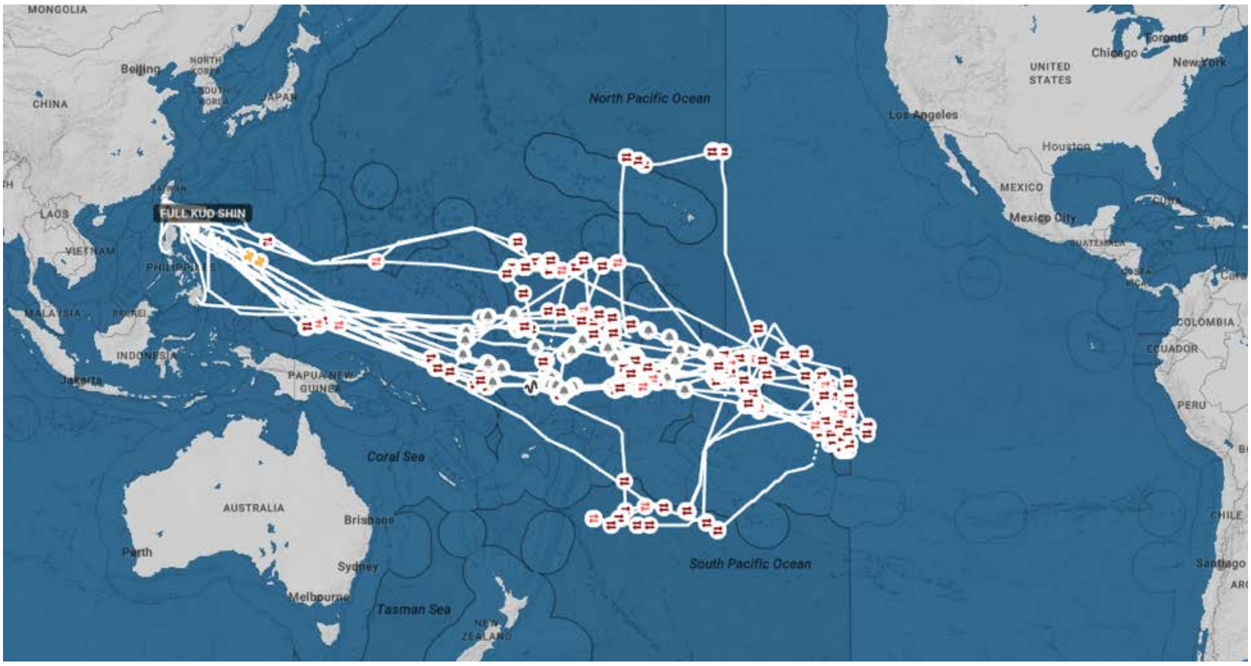


Figure 9: Vessel track of the Full Kuo Shin from 1 May 2020 to 4 November 2023. The symbol with the double red arrows identifies transhipment events. The high seas regions of the WCPFC Convention area are shaded grey. [Starboard link]

4.2.3 <u>Oceanus</u>

The Oceanus is a South Korea-flagged fish carrier, and Busan is its most frequently visited Korean port. In contrast to Full Kuo Shin and Taiho Maru, this vessel appears to also tranship in ports and has visited Rabaul (PNG), Tarawa (Kiribati), Pohnpei (FSM), London (Kiribati), and Funafuti (Tuvalu).

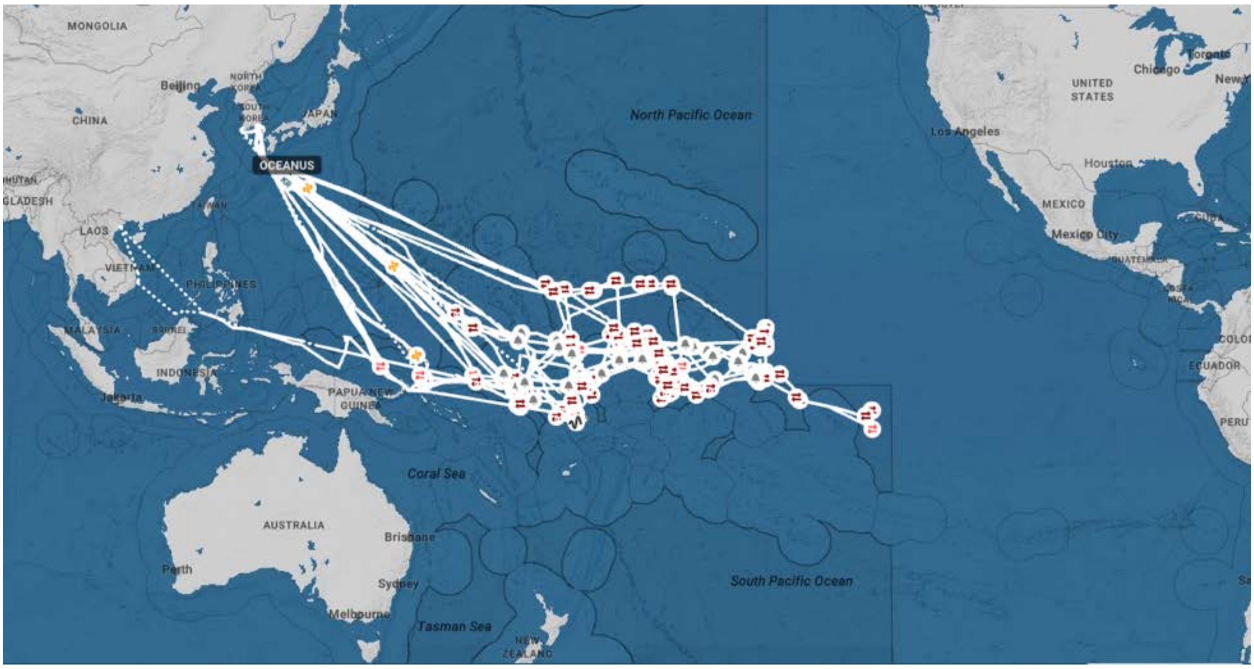


Figure 10: Vessel track of the Oceanus from 1 May 2020 to 4 November 2023. The symbol with the double red arrows identifies transhipment events. The high seas regions of the WCPFC Convention area are shaded grey. [*Starboard link*]

4.2.4 <u>Seiyu</u>

The Seiyu is a South Korea-flagged carrier operating in the western Indian Ocean and the equatorial Pacific. The vessel's activity also extended into the IATTC area east of the WCPFC Convention area. In addition to Busan (South Korea), the vessel frequently visited ports in China, Taiwan, Japan, the Maldives, and Malaysia. Except for two brief visits to Majuro (Marshall Islands) in September 2022 and January 2024, the vessel had no port calls in the western central Pacific.

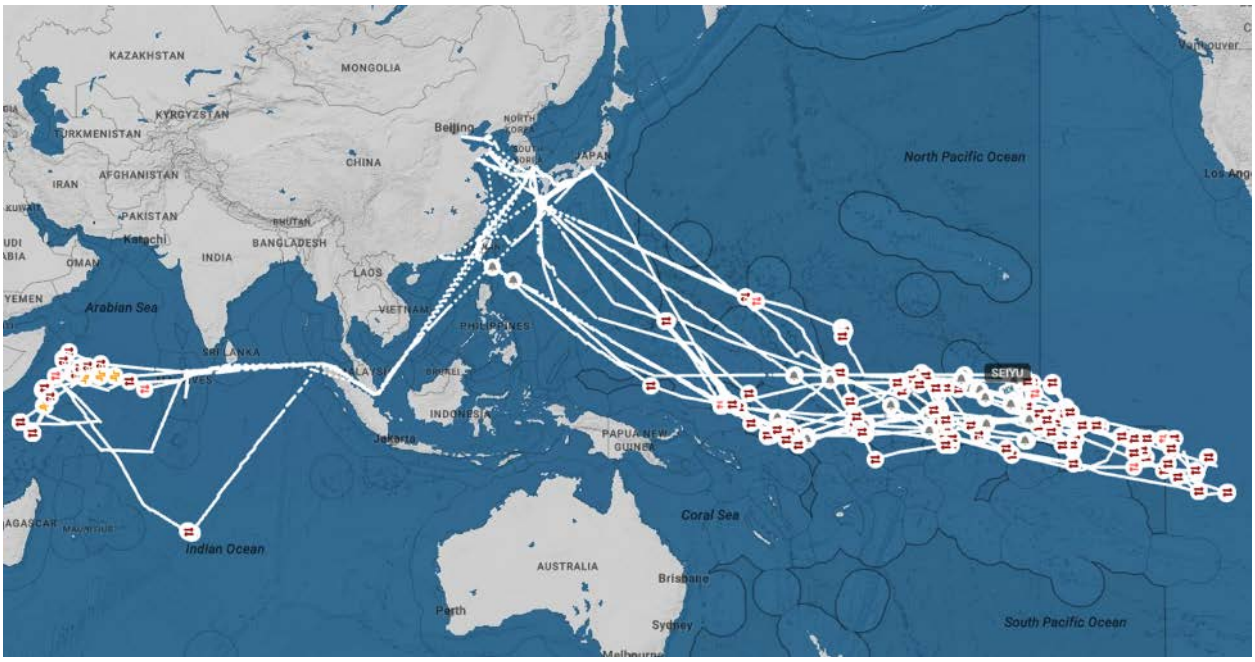


Figure 11: Vessel track of the Seiyu from 1 May 2020 to 4 November 2023. The symbol with the double red arrows identifies transhipment events. The high seas regions of the WCPFC Convention area are shaded grey. [*Starboard link*]

4.2.5 Dong Horng No.899

The Dong Horng No. 899 is a Taiwan-flagged fish carrier whose only port of call was Kaohsiung, Taiwan, between May 2020 to November 2023, with one exception (Manila on 23 May 2022). This carrier's activity involved exclusively high-seas transhipments in the WCPFC Convention area on trips that lasted around 50 or 100 days. Most activities occurred north of the equator, except for one trip to the high seas south of Niue and the Cook Islands in September 2020, where Starboard recorded 12 transhipment events. It is notable that the Dong Horng No. 899 typically ceases AIS transmission on transit to and from Taiwan, up to approximately 900 nm.

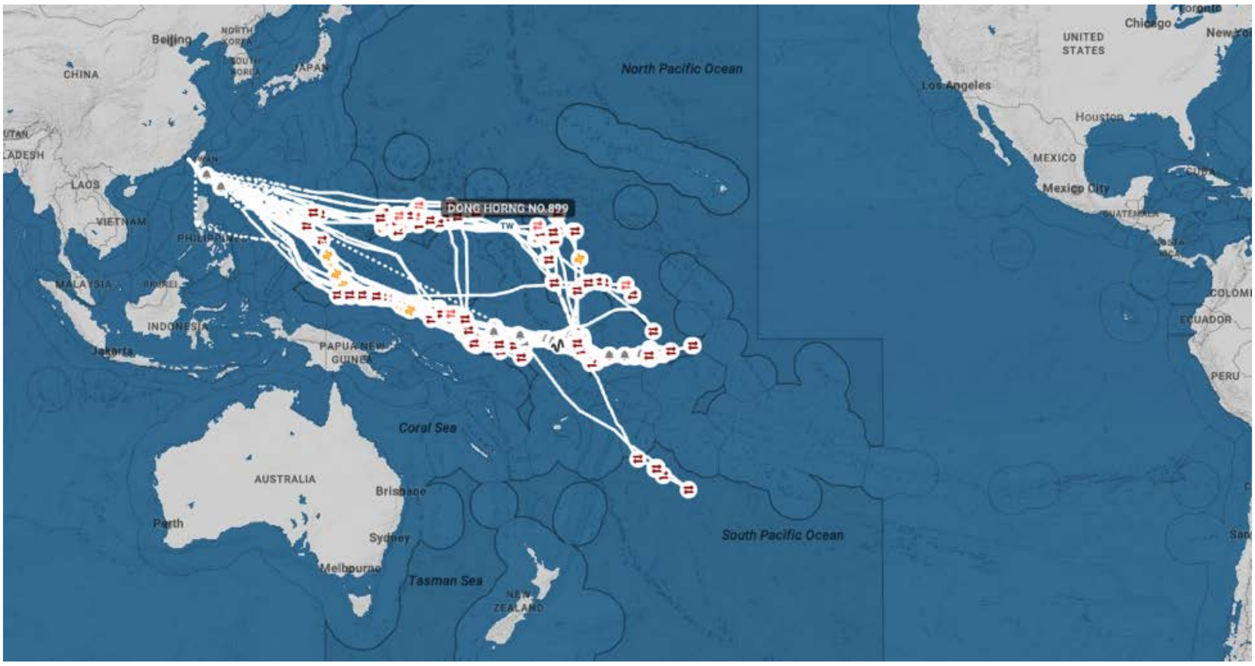


Figure 12: Vessel track of the Dong Horng No.899 from 1 May 2020 to 4 November 2023. The symbol with the double red arrows identifies transhipment events. The high seas regions of the WCPFC Convention area are shaded grey. [*Starboard link*]

4.2.6 Lian Jyi Hsing

The Lian Jyi Hsing is a Taiwan-flagged carrier with an operational pattern very similar to the Dong Horng No.899 (above). Kaohsiung, Taiwan, was its only port of call during the study period, and operations are restricted to the high seas of the central western Pacific. The journeys of the Lian Jyi Hsing are around 50 days. This vessel also does not transmit AIS until it reaches the area where transhipment activities occur, approximately 900 nm southeast of Taiwan. This is the only vessel of the owner Lian Jyi Hsing Marine Products.

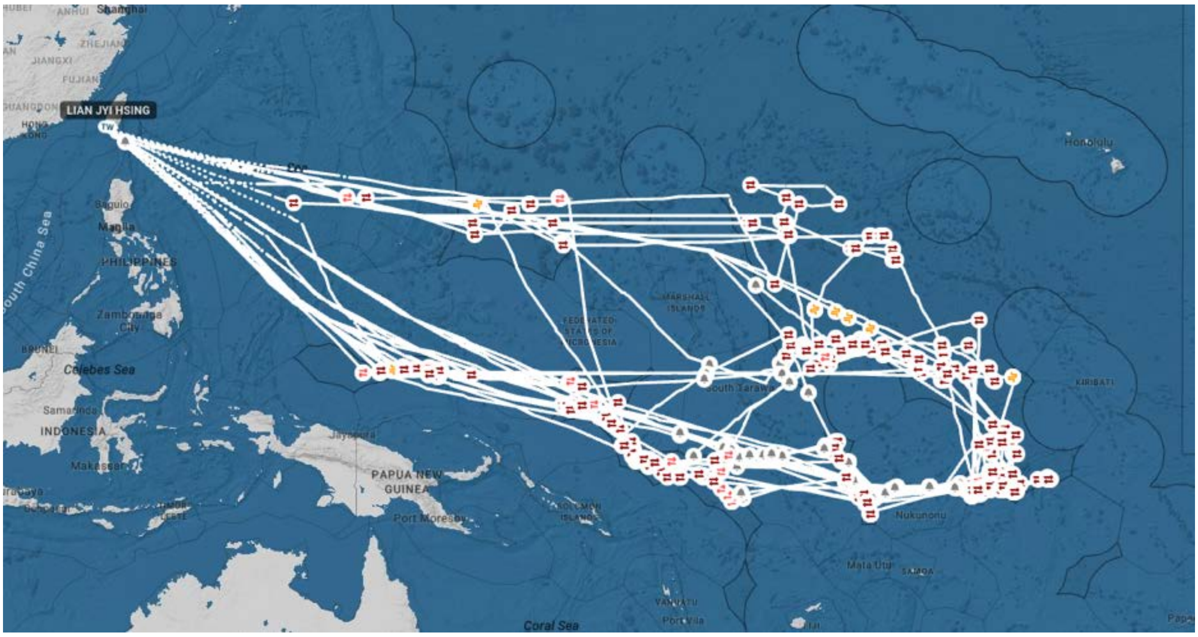


Figure 13: Figure 13: Vessel track of the Lian Jui Hsing from 1 May 2020 to 4 November 2023. The symbol with the double red arrows identify transhipment events. The high seas regions of the WCPFC Convention area are shaded grey. [*Starboard link*]

4.2.7 Seishin

The Seishin is a South Korea-flagged carrier with regular port calls in China, South Korea, Japan, Taiwan, and Malaysia. The area of operation is large, covering the western central Pacific, the adjacent western boundary of the IATTC area, and the western and central Indian Ocean. The vessel transmits AIS during most of its journey, except when travelling through the South China Sea to and from the Strait of Malacca. The registered owner and operator, Green World Co Ltd, also owns the Seishin and the Seibu, all vessels with similar operational patterns.

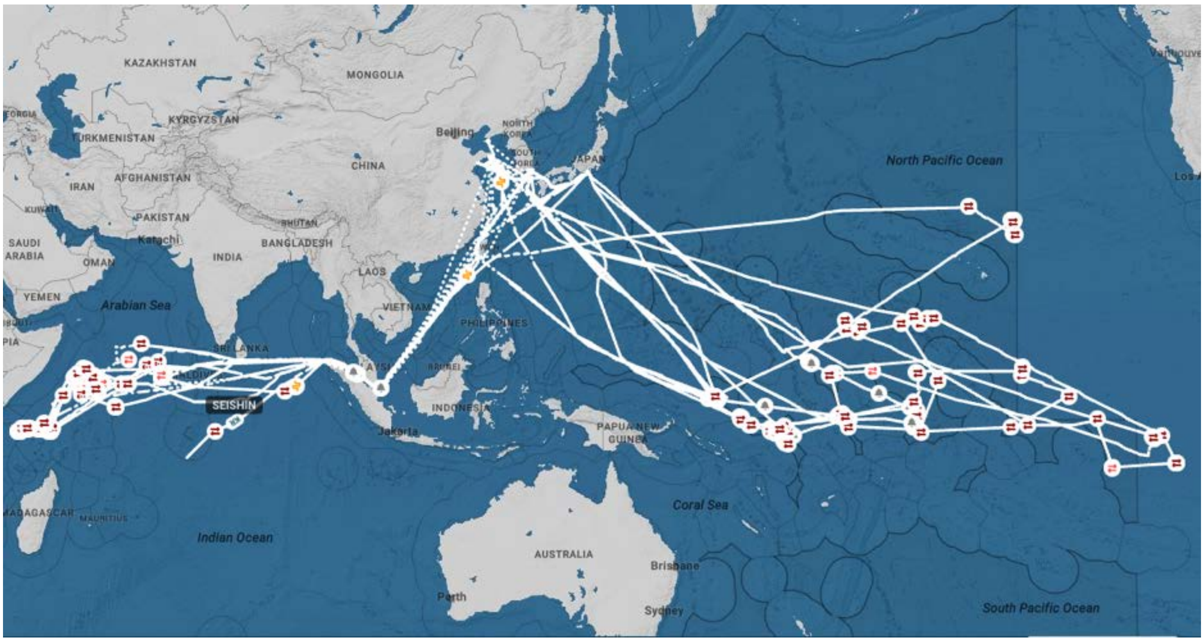


Figure 14: Vessel track of the Seishin from 1 May 2020 to 4 November 2023. The symbol with the double red arrows identifies transhipment events. The high seas regions of the WCPFC Convention area are shaded grey. [*Starboard link*]

4.2.8 <u>Pingtairongleng2</u>

The Pingtairongleng2 is a China-flagged carrier vessel operating in the high seas across the central Pacific eastern and western parts. Most transhipment activities observed during the period of study occurred in the eastern part of the WCPFC Convention area, and in the adjacent IATTC area. The most frequently visited port was Busan, South Korea, followed by Zhoushan, China. The journeys of this vessel are typically around 100 days at sea, occasionally interrupted by short port calls in the Pacific to Apia, Samoa, and Papeete, French Polynesia. The Pingtairongleng2 consistently transmits AIS over the entirely of its journey, with only five outages over the study period. The vessel's owner and operator, Pingtairong Ocean Fishery owns a total of 31 vessels, including another carrier, Pingtairongleng1, and the rest are longliners. These longliners show a strong on-water relationship through regular transhipment activities with the Pingtairongleng carriers.

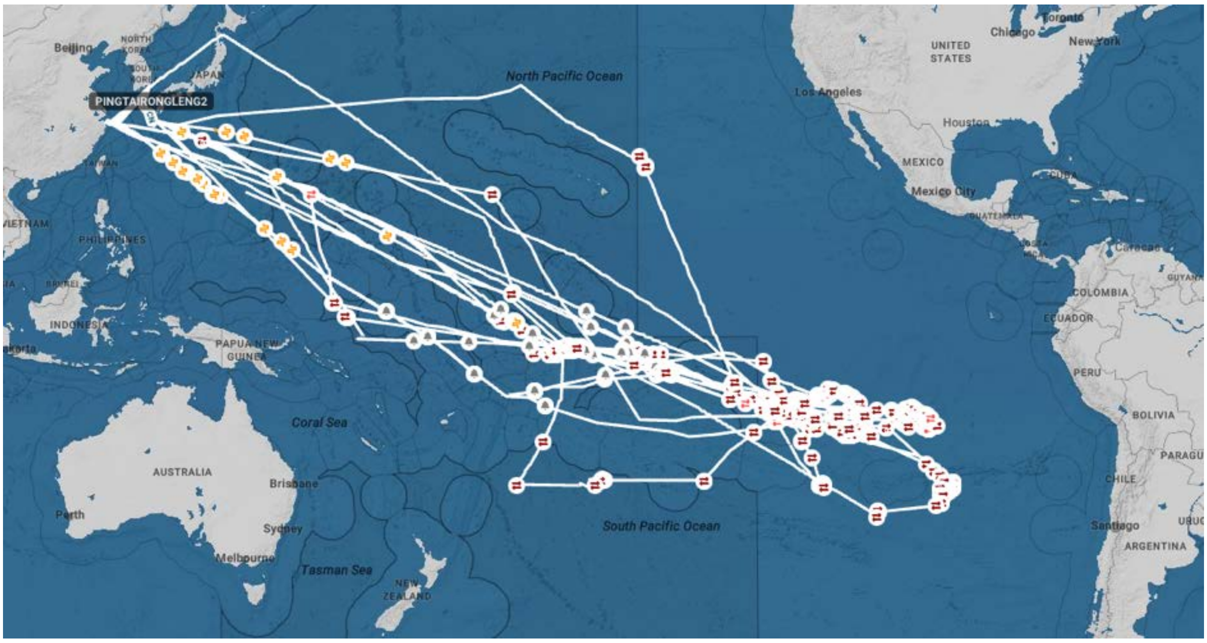


Figure 15: Vessel track of the Pingtairongleng2 from 1 May 2020 to 4 November 2023. The symbol with the double red arrows identifies transhipment events. The high seas regions of the WCPFC Convention area are shaded grey. Starboard link

Table 4: Ownership details of the eight carrier vessels with the most transhipment events

MMSI	356203000	372768000	440237000	440283000	416064900	416730000	441032000	412421074
Vessel name	TAIHO MARU	FULL KUO SHIN	OCEANUS	SEIYU	DONG HORNG NO.899	LIAN JYI HSING	SEISHIN	PINGTAIRON GLENG2
Flag state	Panama	Panama	South Korea	South Korea	Taiwan	Taiwan	South Korea	China
Number of TS events	145	117	91	91	91	89	65	62
Registered owner	Princess Line SA	Full Kuo Corp	Dongwon Industries Co Ltd	Green World Co Ltd	Lin C-Y	Lian Jyi Hsing Marine Products	Green World Co Ltd	Pingtairong Ocean Fishery
Country of control	Japan	Taiwan	South Korea	South Korea	Taiwan	Taiwan	South Korea	China
Country of registration	Panama	Taiwan	South Korea	South Korea	Taiwan	Taiwan	South Korea	China
Group beneficial owner	Hayama Senpaku KK	Unknown	Dongwon Industries Co Ltd	Green World Co Ltd	Lin C-Y	Unknown	Green World Co Ltd	Pingtairong Ocean Fishery
Country of control	Japan		South Korea	South Korea	Taiwan		South Korea	China
Country of registration	Japan		South Korea	South Korea	Taiwan		South Korea	China

4.3 Network of carrier-fishing vessel relationships

The network analysis visually represents our transhipment dataset and shows which fishing vessels transhipped with which carrier vessels (Figure 16). This report includes an HTML file (Attachment: transhipment_network.html) where the network can be explored interactively.

The network diagram quickly identifies the eight central carriers (Table 4) as the most prominent dots connected to many fishing vessels. The three central carriers under Taiwanese control (Full Kuo Shin, Dong Horng No.899, Lian Jyi Hsing) make up a distinct group in the top left of the diagram. Only a few fishing vessels connect these carriers to others. The three South Korean carriers (Oceanus, Seiyu, Seishin) form a similar cluster in the lower part of the network. The Japanese-controlled Taiho Maru is linked to this cluster through several fishing vessels transhipping between them.

The carriers on the right of the diagram near the Pingtairongleng2 are Chinese-controlled vessels with relatively few connections to the other carriers. The Panama-flagged but Taiwanese-controlled Shin Ho Chun No.101 connects the cluster on the right to the Taiwanese-controlled carriers in the top right of the diagram.

Three carriers operate mostly independently in our dataset as identified by their peripheral position in the diagram: Harima (Flag state: Panama, owner country of registration: Singapore, operator country of registration: Japan), Futagami (Flag state: Panama, owner country of registration: China), Lake Aurora (Flag state: South Korea).

Overall, the network analysis suggests the existence of distinct relationships between fishing vessels and carrier vessels, with more connections between carriers from the same flag states than between flag states.

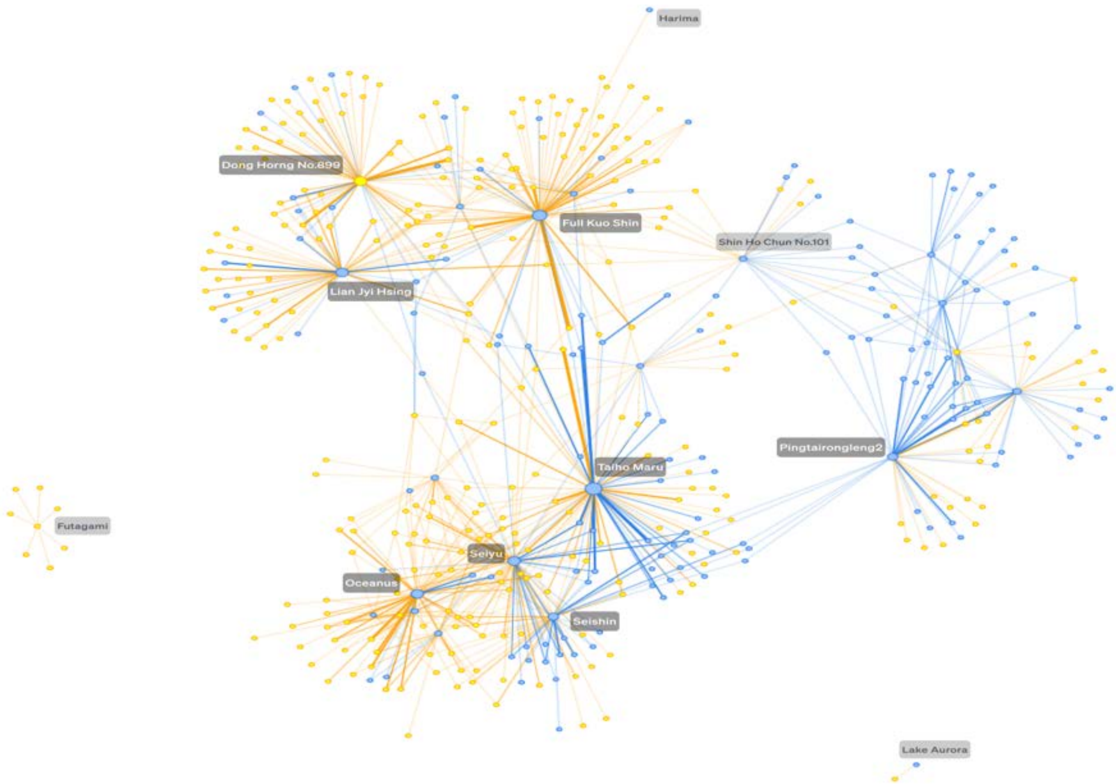


Figure 16: The entire network of our dataset of transhipments. Blue vessels are on the FFA's good standing list. The eight central carrier vessels are identified by name in dark grey boxes. Other carriers mentioned in the text are named in light grey boxes. An interactive HTML file that allows exploration of all vessel names, flags and transhipment numbers is provided in the Attachment: transhipment_network.html.

4.4 Transhipment event characterisation

We have manually inspected and characterised a sample of 50 transhipment events. This has revealed a diversity in geographical patterns of fishing and transit activity of fishing and carrier vessels. As a result of our exploration, we identified three characteristic journey patterns of fishing vessels relevant to the discussion of impracticability in terms of economic feasibility to reach transhipment ports.

These patterns are described below with illustrative examples. We encourage the reader to investigate vessel behaviours. Hyperlinks to the Starboard platform showing the event facilitates this investigation (active registration required). The methods section, *Fishing vessel journey characterisation*, also lists these journey patterns.

4.4.1 Fishing in EEZs of a WCPFC member state, then transhipping in the high seas.

Many fishing vessels fish primarily in the EEZ of one or more of WCPFC's member states and conduct transhipment activities on the high seas. In some cases, the vessels transit straight for hundreds of miles to reach carrier vessels (e.g., ZHONGRONG 33 on 13/08/2021, Figure 20). This allows for the straightforward identification of the purpose of the journey and its economic cost in terms of time and fuel consumption. However, often, fishing vessels take time to travel from the primary fishing area to the site of upcoming transhipment and conduct fishing activity along the way while waiting for their turn to meet the carrier (e.g., LURONGYUANYU658 on 17/05/2023, Figure 19). In these cases, interpreting the vessel track concerning transhipment activity is less straightforward as travelling and fishing sections are hard to distinguish. In these situations, the objectively calculated centre of the fishing area can often help, as it is weighted by the duration of fishing events. This weighting draws the centre closer to where most fishing activity occurred and gives less weight to opportunistic fishing during waiting periods (e.g., LURONGYUANYU658 on 17/05/2023, Figure 19).

The vessels in this category are usually on the FFA good standing list and often have regional port visits. For example, XIN SHI JI 7 calls into Suva, Fiji, on 23 February 2022, only seven days after transhipping on the high seas (Figure 17).

The vessels in this category are the most likely candidates for questionable application of the impracticability exemption for in-port transhipment. Further effort to identify these vessels operationally is recommended. A tentative interpretation of the route lengths is given in the section *Summary statistics of journey metrics*, below. These statistics highlight which ports are most negatively impacted by high-seas transhipments and which boats are the most frequently involved.

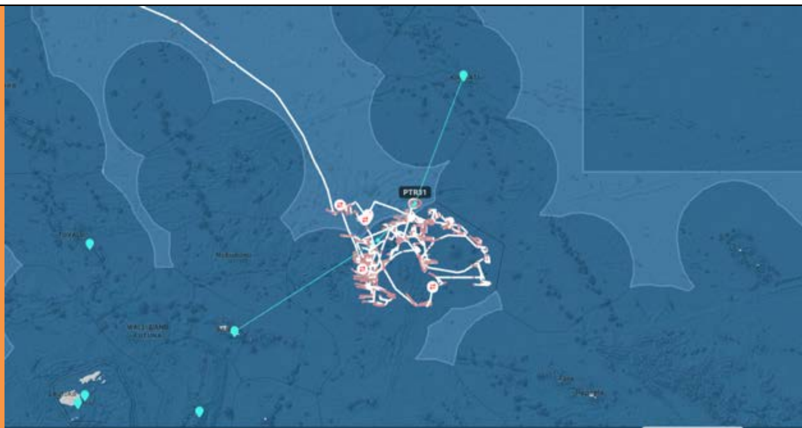
Fishing vessel	
MMSI	412985000
Name	XIN SHI JI 7
Flag	China
Carrier Vessels	
MMSI	356203000
Name	TAIHO MARU
Flag	Panama
Date (UTC)	17/02/2022

This vessel steams straight from Busan, Korea, to fish in the high seas and the Kiribati EEZ. During fishing activities, it comes close to Kirimati. Immediately after the high-seas transhipment, the vessel heads to Fiji where it arrives in Suva on 23 February 2022. This vessel had two reasonably close approaches to transhipment ports. Starboard link

Distance to high-seas transhipment	Distance to nearest transhipment port	Closest approach to transhipment port
364 NM	491 NM	0 NM

Figure 17: Example of a transhipment event. The magenta symbols are the journey metrics from Table 2 (arrows), the centre of fishing activity (small dot), and transhipment ports (location markers).

Fishing vessel	
MMSI	412420239
Name	PTR31
Flag	China
Carrier Vessels	
MMSI	412421071
Name	PINGTAIRONGLENG6
Flag	China
Date (UTC)	2/6/2023



In 2023, this vessel fished primarily in the Cook Island EEZ and only a short distance north to the high seas for transhipment. Some fishing activities appear on the high seas prior to and after transhipment. This vessel has eight transhipments in our dataset, making it one of the most active vessels of this study (Figure 7). With the absence of suitable transhipment facilities in the Cook Islands, high-seas transhipment activity appears economically beneficial. Similar examples are ZHOUYUANYU2605, and ZHOU YUAN YU 2606, both served by the carrier PINGTAIRONGLENG2. Starboard link

Distance to high-seas transhipment	Distance to nearest transhipment port	Closest approach to transhipment port
196 NM	625 NM	510 NM

Figure 18: Example of a transhipment event. The magenta symbols are the journey metrics from Table 2 (arrows), the centre of fishing activity (small dot), and transhipment ports (location markers).

Fishing vessel	
MMSI	412333794
Name	LURONGYUANYU658
Flag	China
Carrier Vessels	
MMSI	441032000
Name	SEISHIN
Flag	South Korea
Date (UTC)	17/05/2023

This vessel fishes in the EEZ of Papua New Guinea and travels to a high seas pocket for transhipment and along the way between these areas. The activity outside the Solomon Sea may be interpreted as setting lines when opportunity arises while en-route to and waiting for carriers, while the actual fishing area is elsewhere. This behaviour potentially hinders the evaluation of economic hardship and skews automated calculation of distances. In this case, the duration weighting of the calculation of the fishing area location works well as it gives less importance to brief fishing activities. [Starboard link]

Distance to high-seas transhipment	Distance to nearest transhipment port	Closest approach to transhipment port
805 NM	336 NM	143 NM

Figure 19: Example of a transhipment event. The magenta symbols are the journey metrics from Table 2 (arrows), the centre of fishing activity (small dot), and transhipment ports (location markers).

Fishing vessel	
MMSI	412326881
Name	ZHONGRONG 33
Flag	China
Carrier Vessels	
MMSI	441032000
Name	SEISHIN
Flag	South Korea
Date (UTC)	13/08/2021

This vessel fishes in the EEZ of Papua New Guinea and travels in a straight line to a high-seas pocket for transhipment. Following transhipment, still in the high seas, the vessel encounters with a tanker and another longliner. After these encounters, the vessel steams straight back to the earlier fishing areas. This is a typical example of vessels fishing in the PNG EEZ, and transhipping in the high seas. [Starboard link]

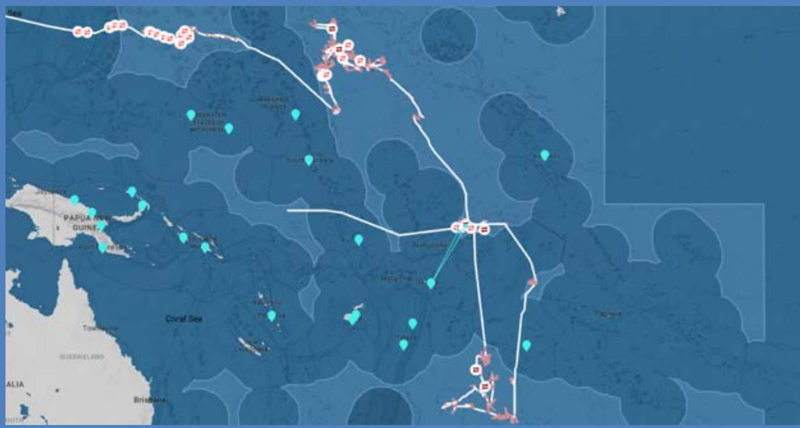
Distance to high-seas transhipment	Distance to nearest transhipment port	Closest approach to transhipment port
795 NM	258 NM	88 NM

Figure 20: Example of a transhipment event. The magenta symbols are the journey metrics from Table 2 (arrows), the centre of fishing activity (small dot), and transhipment ports (location markers).

4.4.2 Fishing exclusively, or predominantly, in the high seas, but transiting PICs EEZs and passing suitable ports

The western central Pacific Ocean is heavily fished by vessels that commute between high seas areas through WCPFC member states' EEZs. These cases provide good examples of how a decision-making process to define impracticability would be very helpful in identifying potential abuses of the CMM.

Fishing vessel	
MMSI	416211600
Name	CHIUANFACHENG NO166
Flag	Taiwan
Carrier Vessels	
MMSI	416064900
Name	DONG HORNG NO.899
Flag	Taiwan
Date (UTC)	12/07/2020

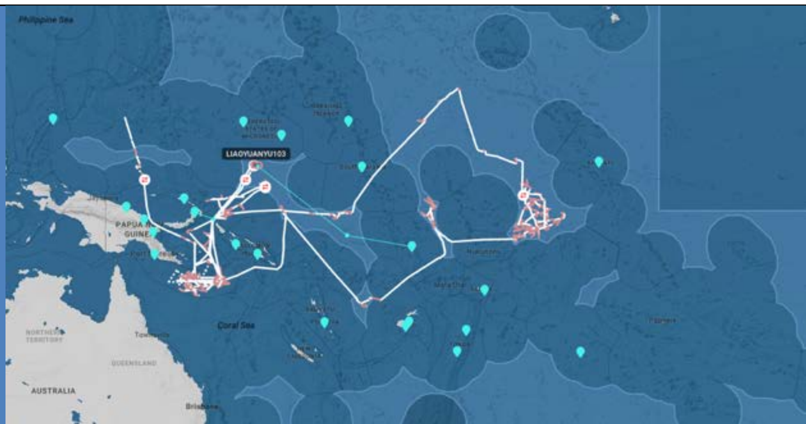


This vessel covers large distances transiting between fishing areas in the high seas. It has several transhipment events in the area where it is fishing. The nearest transhipment port for this event is Apia, Samoa, about 450 NM from the site of the transhipment, and 330 NM from the vessel as it transits southwards. Starboard link

Distance to high-seas transhipment	**Distance to nearest transhipment port**	**Closest approach to transhipment port**
12 NM	500 NM	438 NM

Figure 21: Example of a transhipment event. The magenta symbols are the journey metrics from Table 2 (arrows), the centre of fishing activity (small dot), and transhipment ports (location markers).

Fishing vessel	
MMSI	412549222
Name	LIAOYUANYU103
Flag	China
Carrier Vessels	
MMSI	412421074
Name	PINGTAIRONGLENG2
Flag	China
Date (UTC)	5/2/2021



This vessel has six transhipments in our dataset. It visits all high seas areas of our study region and spends much time fishing in the EEZ of Papua New Guinea. The location of the calculated centre of the fishing area reflects the geographically distributed fishing activity of this vessel. Owing to the large distances this vessel is prepared to travel, several transhipment ports are within reach, especially Raboul, PNG, with 148 NM from one point on its track. Starboard link

Distance to high-seas transhipment	**Distance to nearest transhipment port**	**Closest approach to transhipment port**

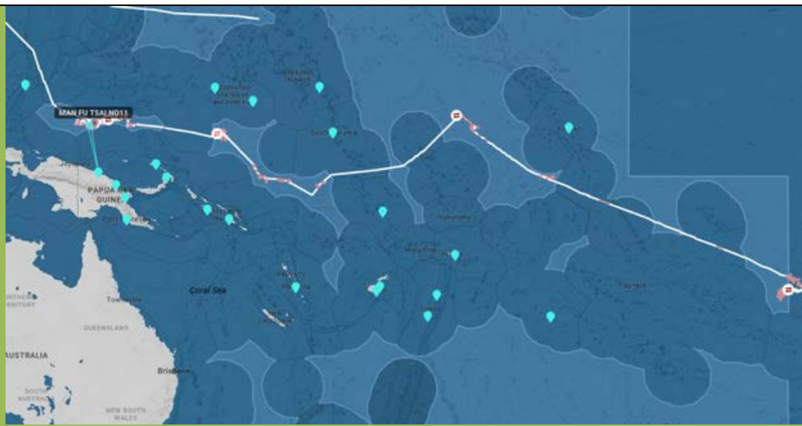
860 NM	486 NM	148 NM

Figure 22: Example of a transhipment event. The magenta symbols are the journey metrics from Table 2 (arrows), the centre of fishing activity (small dot), and transhipment ports (location markers).

4.4.3 <u>Fishing in remote high seas areas, rarely entering EEZs, and transhipping with passing carrier vessels.</u>

This type of journey pattern is typical of distant water fishing vessels whose operational model is based on bunkering, transhipping and provisioning at sea. Vessels in the WCPFC convention area often have similar activity in the eastern Pacific and Indian Oceans. They are typically not licensed to any coastal state in the Pacific and are not on the FFA good standing list. Yet they enter ports in the region (e.g., Suva and Apia) approximately yearly. It appears plausible that the impracticability exemption was initially conceived only to support operators with these historical and economical operational modes.

Fishing vessel	
MMSI	416000301
Name	MAN FU TSAI NO11
Flag	Taiwan
Carrier Vessels	
MMSI	37276800
Name	FULL KUO SHIN
Flag	Panama
Date (UTC)	5/8/2021



With nine transhipments in our dataset, this vessel is one of the two most active transshippers. It is not on the FFA good standing list. Its journey pattern is characterised by fishing exclusively in the high seas and staying well away from EEZ boundaries. When the vessel crosses EEZs it appears to choose routes that are as far away from land as possible, often straddling the boundaries of two EEZs. The vessel was at sea for almost 12 months. It came into Apia port for less than 2 weeks and then into Suva for less than 10 days after another 11 months at sea. [Starboard link]

Distance to high-seas transhipment	**Distance to nearest transhipment port**	**Closest approach to transhipment port**
48 NM	386 NM	348 NM

Figure 23: Example of a transhipment event. The magenta symbols are the journey metrics from Table 2 (arrows), the centre of fishing activity (small dot), and transhipment ports (location markers).

4.5 Development of journey metrics

The characterisation of transhipment events suggested that measuring the distances a vessel travels to reach a high-seas transhipment location versus a suitable port helps describe the economic implications regarding time and fuel consumption. Manually measuring the distances to transhipment sites and ports revealed the question of where to measure the distances from. As the above examples show, many fishing vessels have geographically distributed fishing locations and often fish in the area where the transhipment takes place.

We found that a geographical centre of fishing events would be most representative and decided that all fishing events since the last transhipment or port visit and the high-seas transhipment should be considered. Using the mean location of all fishing events during that period, weighted by the duration of the event, provides an estimate of the central fishing area for a vessel. Knowing the mean location allows us to automate the calculation of the distance to where the high-seas transhipment took place and the distance to the nearest transhipment port. When assuming that the distances are proportional to the cost expenditure, we can interpret the ratio of the two distances in terms of potential economic hardship.

In some cases, fishing vessels pass transhipment ports relatively closely during transit between fishing grounds. Such proximity presents an economically favourable opportunity to tranship catch in a port. We determined the shortest distance between the vessel and a transhipment port within two weeks on either side of the transhipment event to capture this opportunity.

4.5.1 Summary statistics of journey metrics

The journey metrics (Table 2) were calculated for each transhipment event in our dataset. The calculation results are provided in the example events in the previous section (Figures 17 to 23), and the distances are marked on each map. An argument may be made that in transhipment events where the distance from the main fishing area to the transhipment location is greater than the distance to a suitable port, a transhipment in port would be more favourable economically. Therefore, a ratio of these two distances (distance to high-seas transhipment/distance to nearest transhipment port) greater than one indicates a potential flaw in the economic hardship argument.

We investigated two statistical summaries of this ratio to derive general patterns from this dataset that potential policy changes may address. First, we look at all ratios by the nearest transhipment port (Table 5). Any port where the ratio of the medians is around one or greater potentially loses out on port calls by fishing vessels that travel greater distances to reach carriers on the high seas. According to this calculation, high-seas transhipments involving vessels that fished in relative proximity to ports in PNG (Rabaul, Port Moresby and Kavieng), the Solomon Islands (Noro), and Tonga (Nukualofa) often travel excessively for transhipment.

The port of Nukualofa (Tonga) has limited transhipment facilities due to the absence of a deep lagoon, and fishing vessels arguably prefer travelling an extra distance for high-seas transhipment.

For several ports, fishing vessels travel approximately equal distances to high-seas transhipments than they would have to travel to a port (Kosrae, FSM; Funafuti, Tuvalu; Tarawa, Kiribati; Vavau, Tonga). For some ports, the ratio is less than one (Majuro, RMI; Apia, Samoa; Kirimati, Kiribati; Pohnpei, FSM; Wewak, PNG; Honiara, Solomon Islands). This suggests that fishing areas are remote from suitable transhipment ports, and carrier vessels provide a more economical way to offload catch.

We have also summarised the ratio by carrier vessel to reveal behaviour patterns between associated vessels (Table 5). We found that the ratio was around one or greater for eleven carriers (Seishin*, Meita Maru, Genta Maru, M/V Badaro, Sl Archi, Hanaro, Seiyu*, Lake Dream, Futagami, Oceanus*, Heng Hong 5; central carriers marked with asterisk). According to our interpretation, these carriers receive fish that could have been offloaded in port with less or equal travel-related expenditure. The ratio is less than one for the remaining carriers, indicating that they generally receive fish caught far away from suitable port facilities.

The ratio of median distances for fishing vessels ranges from 0.01 to 5.68 (Figure 24). Several vessels in our dataset have more than one transhipment event and a median distance ratio greater than or equal to two (Table 6). According to our interpretation, these vessels made multiple journeys more than twice as expensive to reach a carrier vessel on the high seas than from the central fishing area to a transhipment port.

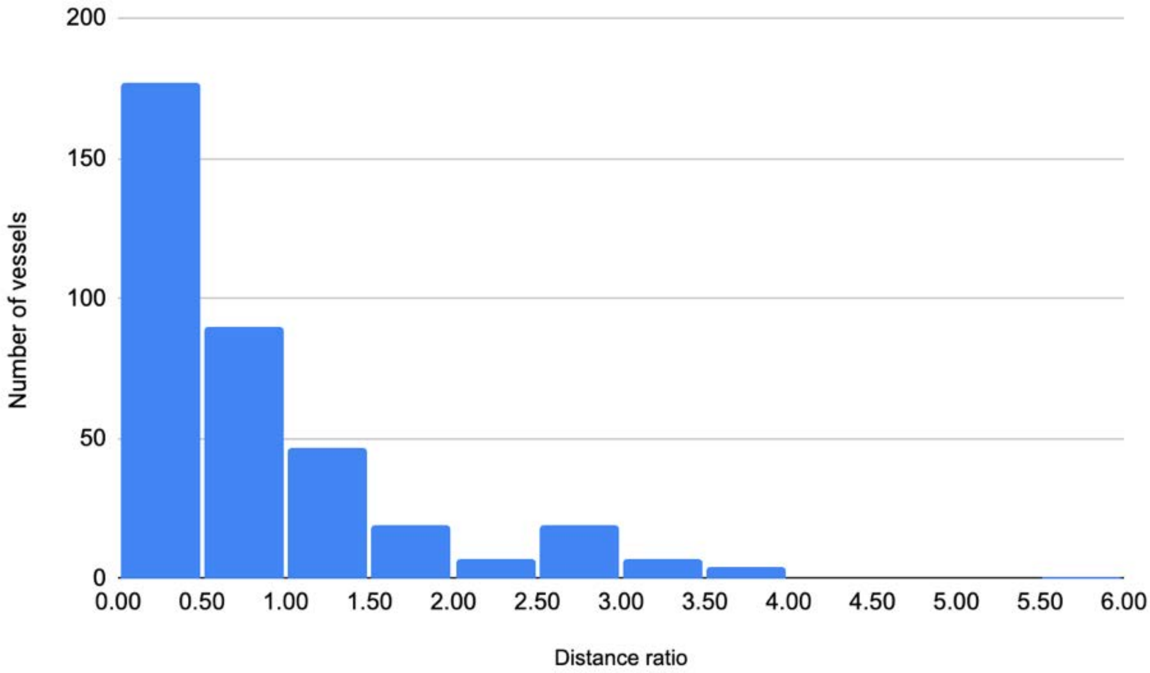


Figure 24: Histogram of the median distance ratio for fishing vessels

We also aggregated the metric describing the closest approach to a transhipment port by port, carrier vessel and fishing vessel. We found that the summary statistics of this metric were similar to those reported in Tables 5 to 7. Individual cases with close approaches or actual calls to ports usually caused differences between the metrics. Therefore, we consider the nearest approach to a transhipment port most helpful in an operational case-by-case evaluation of vessel behaviour.

In summary, the automated calculation of distances related to fishing and transhipment activities provides several insights that would be hard to gain using manual inspection. Aggregation of the distance ratio reveals:

- The geographical area where high-seas transhipment occurs generally appears more costly than in-port transhipment.
- The carrier vessels that receive a large portion of fish potentially caught closer to a port than to the transhipment location, and
- The fishing vessels that repeatedly travel further to high-seas transhipment than the distance to a suitable port.

In addition to automated calculation, the objective determination of fishing areas and distances avoids bias by the investigator, such as the eye being drawn to shorter periods of fishing activity that are less significant for the overall pattern of behaviour. For example, the centre of fishing activity often accurately reflects a central location, even without being near any actual fishing activity (Figure 22).

We note that this is the first time we have calculated these distance metrics. Of particular importance for these metrics is the concept and accurate determination of the centre of fishing activity for a given vessel. Fishing activity detection relies on Starboard's machine-learning algorithm that classifies vessel tracks into fishing and non-fishing sections based on AIS data. Visual inspection suggests that this classification generally works well, but the algorithm sometimes fails to detect likely fishing activity or falsely classifies unremarkable track sections as fishing. These false positive and false negative fishing event detections affect the location of the central fishing area. Furthermore, fishing activity may not be detected when vessels have gaps in the track from temporary outages of AIS transmissions.

Table 5: Median journey metrics (Table 2) and the ratio of the two distances by nearest transhipment port.

Only transhipment events involving fishing vessels on the FFA good standing list were included in the median.

Port closest to fishing area	Median distance to nearest transhipment port (NM)	Median distance to high-seas transhipment (NM)	No. transhipments	Distance ratio
Rabaul, PNG	156	514	14	3.30
Noro, Solomon Islands	231	696	39	3.01
Port Moresby, PNG	287	783	6	2.73
Kavieng, PNG	407	929	8	2.28
Nukualofa, Tonga	1366	1621	5	1.19
Kosrae, FSM	354	382	2	1.08
Funafuti, Tuvalu	343	367	70	1.07
Tarawa, Kiribati	476	480	69	1.01
Vavau, Tonga	1536	1360	9	0.89
Majuro, RMI	724	499	65	0.69
Apia, Samoa	584	235	86	0.40
Kirimati, Kiribati	824	328	424	0.40
Pohnpei, FSM	513	188	17	0.37
Wewak, PNG	410	103	7	0.25
Honiara, Solomon Islands	434	94	15	0.22

Table 6: Median journey metrics (Table 2) and the ratio of the two distances by carrier vessel.

Only transhipment events involving fishing vessels on the FFA good standing list were included in the median.

MMSI	Name	Median distance to nearest transhipment port (NM)	Median distance to high-seas transhipment (NM)	No. transhipments	Distance ratio
441032000	Seishin*	308	635	54	2.06
372047000	Meita Maru	427	802	5	1.88
374888000	Genta Maru	261	416	3	1.59
440217000	M/V Badaro	478	747	15	1.56
441240000	Sl Archi	361	537	7	1.49
373417000	Hanaro	525	623	21	1.19
440283000	Seiyu*	393	466	72	1.18
441407000	Lake Dream	715	776	8	1.09
373381000	Futagami	2413	2616	4	1.08
440237000	Oceanus*	497	459	80	0.92
413312990	Heng Hong 5	521	468	7	0.90
441418000	Seibu	557	415	26	0.75
374140000	Shin Ho Chun No.102	790	498	4	0.63
416730000	Lian Jyi Hsing*	587	368	71	0.63
352894000	Mylo	1803	811	14	0.45
412421073	Pingtairongleng1	650	277	29	0.43
412421074	Pingtairongleng2	648	271	43	0.42

356203000	Taiho Maru*	717	286	121	0.40
416064900	Dong Horng No.899*	477	187	68	0.39
372768000	Full Kuo Shin*	795	310	99	0.39
412421071	Pingtairongleng6*	791	295	15	0.37
374048000	Shin Ho Chun No.101	921	332	21	0.36
374723000	Yun Run 3	647	163	17	0.25
356889000	Angara	1587	293	3	0.18
416602000	Shun Tian Fa No168	1421	253	6	0.18
441258000	Lake Aurora Ai	253	44	1	0.18
416702000	Sheng Hong	1743	217	19	0.12
576728000	Lung Yuin	1640	57	3	0.03

Table 7: Fishing vessels with two or more transhipments with a median distance ratio greater than two. Only fishing vessels on the FFA good standing list are shown.

MMSI	Name	Median distance to nearest transhipment port (NM)	Median distance to high-seas transhipment (NM)	No. transhipments	Distance ratio
416004662	De Chan	261	1482	3	5.68
412326877	Rongtai8	164	613	2	3.75
440992000	Atun Tres	196	714	2	3.64
412329417	Lurongyuanyu589	175	627	4	3.58
412549105	Lurongyuanyu357	206	665	5	3.23
412329416	Lurongyuanyu326	181	578	3	3.20
440809000	619 Dongwon	227	714	3	3.15
412549104	Lurongyuanyu356	193	603	4	3.13
440522000	Panalox 506	363	1125	2	3.10
440780000	No.621 Dong Won	229	703	4	3.07
440986000	316oryong	460	1359	2	2.95
412326881	Zhongrong 33	246	714	4	2.90
412329793	Lurongyuanyu559	223	640	2	2.87
412549221	Liaoyuanyu101	251	721	6	2.87
412333792	Lurongyuanyu558	214	596	2	2.79
412549222	Liaoyuanyu103	272	724	6	2.66
412329588	Luweijingyu60557	284	749	2	2.63
412329433	Lurongyuanyu789	228	595	2	2.62
412329429	Lurongyuanyu769	268	685	2	2.55
440936000	Oryong No 722	229	581	3	2.54
416002195	Yi Rong No.16	408	1027	2	2.52
412329428	Lurongyuanyu768	239	602	2	2.52
412333794	Lurongyuanyu658	258	636	2	2.47

412326882	Zhong Rong 32	311	762	2	2.45
412333795	Lurongyuanyu659	250	610	2	2.44
440733000	306 Oryong	373	861	3	2.31
440646000	No.803 Dongwon	524	1059	3	2.02

5 Framework

The approach we developed in this work to contribute to assessing the economic implications of transhipment can be applied in practice to individual vessels with a high-seas transhipment event. Here, we present step-by-step instructions for practitioners to determine the distance metrics.

The method requires geospatial software to display vessel tracks and locations and allow distance measurements. We demonstrate the method using the Starboard platform.

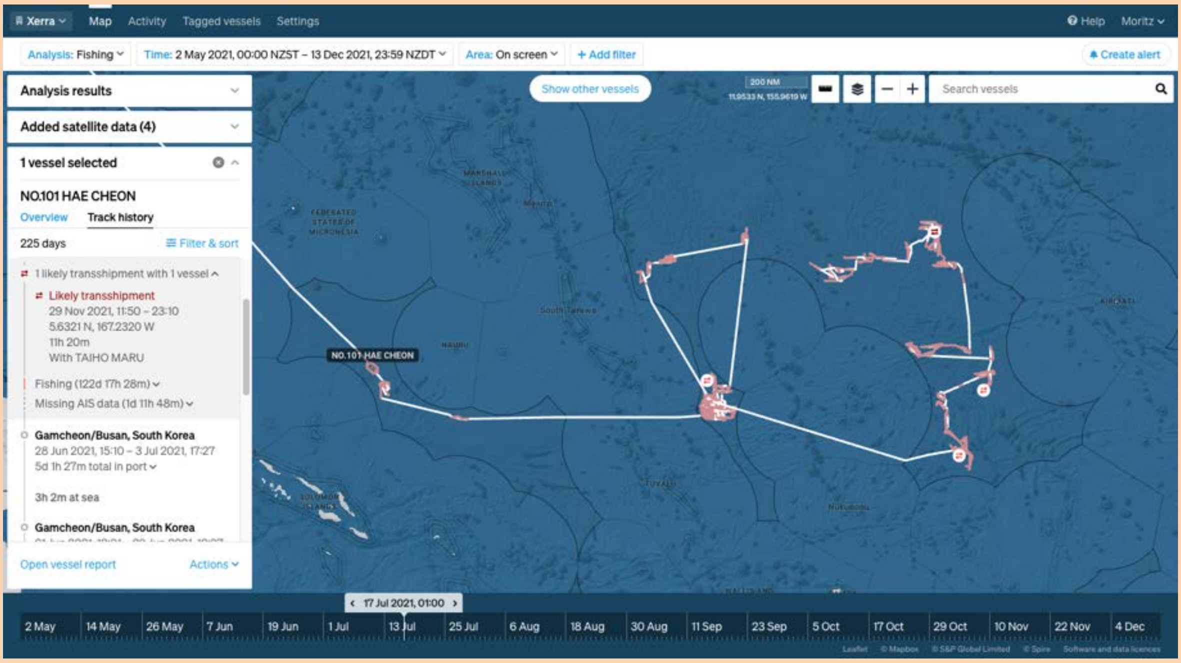
The information needed includes:

- Location of transhipment ports (Table 2);
- Date and location of a high-seas transhipment event;
- Date of previous port call or at-sea transhipment event;
- Track of the vessel since the last port call or last at-sea transhipment;
- Fishing activity marked on vessel track; and
- Vessel track for two or more weeks after high-seas transhipment event;

In interpreting the distance ratio, we assume that the distance travelled by a fishing vessel to reach a transhipment site is the most significant factor in justifying the argument of economic hardship.

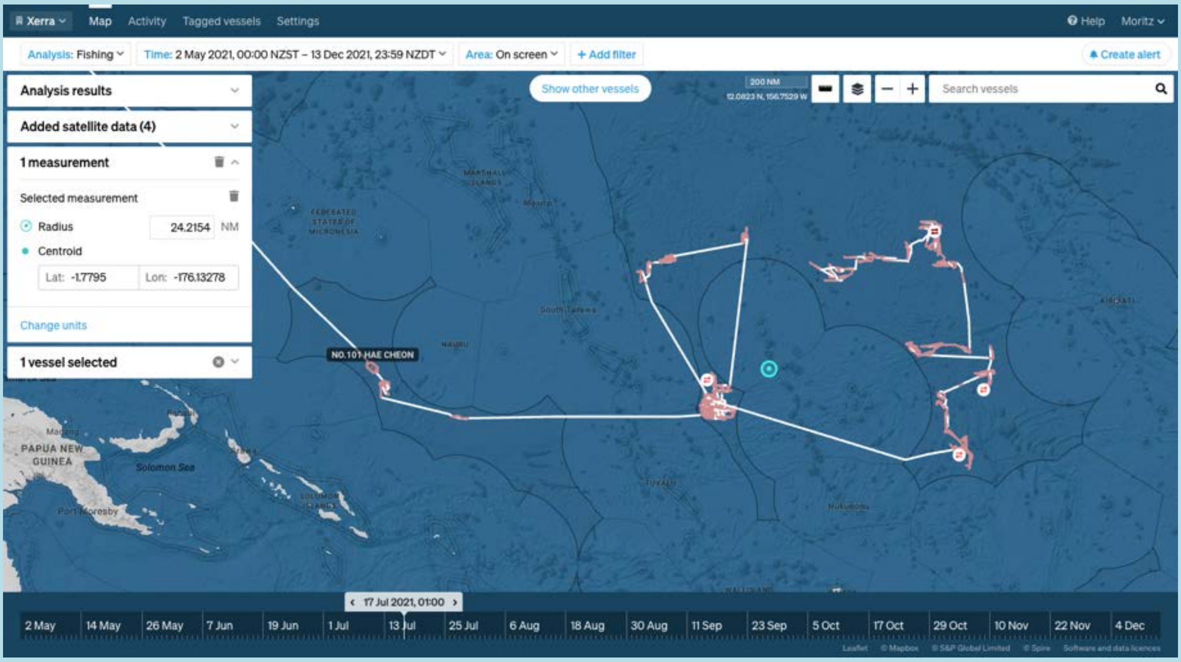
5.1 Step-by-step instructions

1. Given a vessel of interest with a high-seas transhipment event, determine the previous port call or at-sea transhipment. Interpret the vessel track to find the first fishing event after the port call or transhipment.



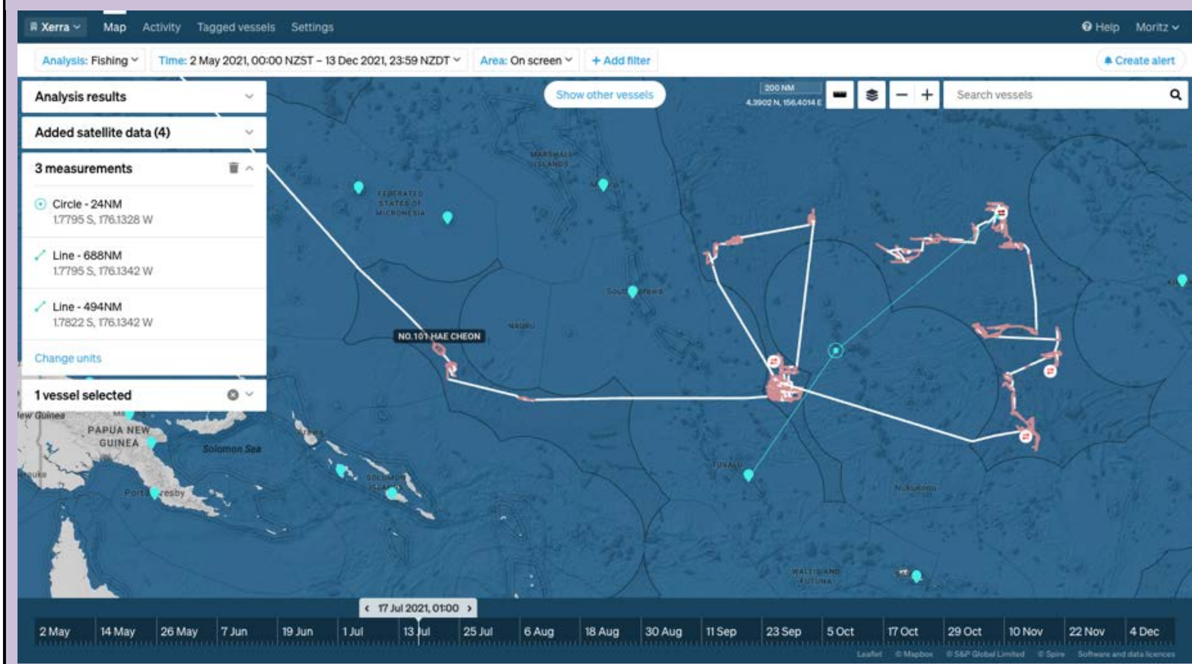
This vessel has a transhipment event in the high seas west of Kiribati on 29 November 2021 (symbol with dark red opposing arrows in the northeastern portion of the track). It arrived in the area from Busan, South Korea, in July 2021. In Starboard, fishing activity is indicated by a pink vessel track. The symbol with light red opposing arrows marks encounters with other vessels.

2. Estimate the central fishing area. Give proportionally less weight to shorter periods of fishing (such as those of the western part of the track). A visual estimation can be done using Starboard, where a point can be marked using the circle measurement tool.



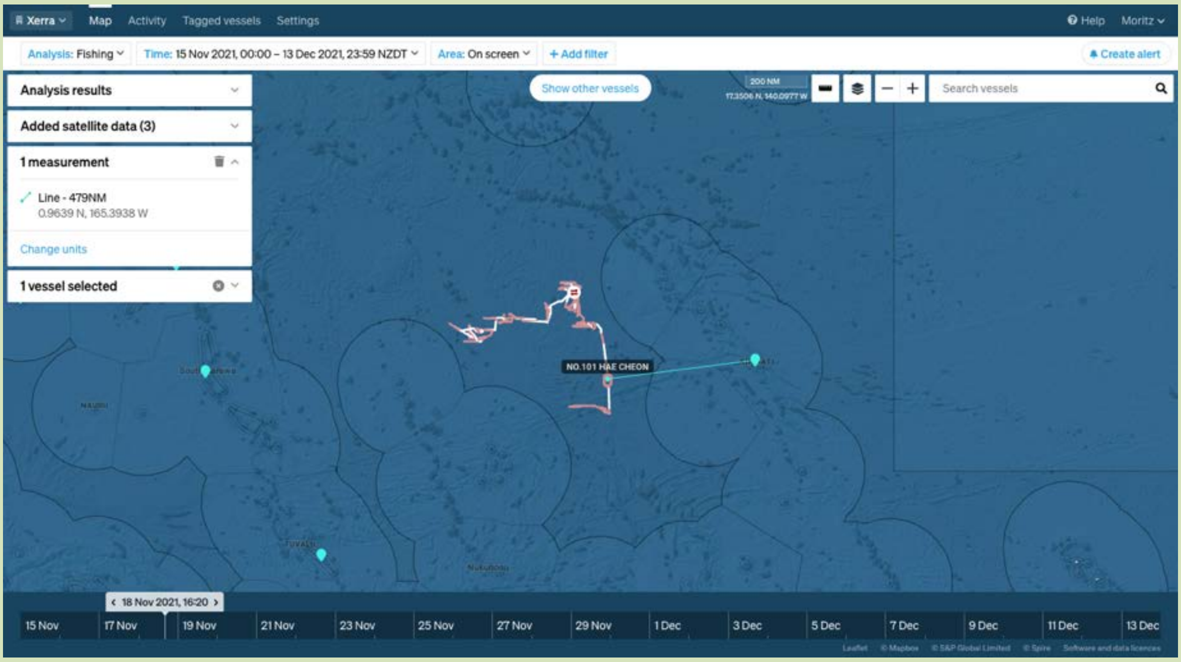
The central fishing area is estimated and marked by a turquoise measurement circle. Note that the location of a visually estimated central fishing area may be different to an algorithmically estimated location, because it is difficult to gauge the time spent in certain areas when the tracks are overlapping. [Starboard link]

3. Measure the distance from the central fishing area to the location of the high-seas transhipment, and to the nearest transhipment ports. In Starboard, the line measurement tool can be used. To display transhipment ports in Starboard, drag a geojson file with the locations into the browser window (file attached to this report: FFA_transhipment_ports.json). [Starboard link]



The distance from the central fishing area to the high-seas transhipment (688 NM) and to the nearest transhipment port (Funafuti, Tuvalu, 494 NM) are measured using the line measurement tool. Transhipment ports are indicated by turquoise location markers. [Starboard link]

4. Inspect two weeks of vessel track to either side of the transhipment event. Measure the distance to the closest transhipment port from the vessel track within this time period. [Starboard link]



Using the time selector at the top of the screen, the vessel track is clipped to two weeks on either side of the date of transhipment. The line measurement tool is used to measure the distance to the nearest transhipment port (Kiritimati, Kiribati, 479 NM). [Starboard link]

5. Compare the distances

The distances measured in steps three and four are:

- Distance to high-seas transhipment: 688 NM
- Distance to nearest transhipment port: 494 NM
- Closest approach to transhipment port: 479 NM

The following ratios relate the distances:

$$\frac{Distance\ to\ high - seas\ transshipment}{Distance\ to\ nearest\ transshipment\ port} = 1.40$$

$$\frac{Distance\ to\ high - seas\ transshipment}{Closest\ approach\ to\ transshipment\ port} = 1.44$$

If either of these ratios is greater than one, the vessel has travelled further to the transhipment than the distance to a suitable transhipment port. When the central fishing area has been visually estimated, greater care should be taken when interpreting the ratios.

We propose the following interpretation of the ratios for travel-related expenses:

Distance ratio	Interpretation
Greater than 1.2	In-port transhipment may have been more economical than high-seas transhipment.
0.8 - 1.2	High seas transhipment and in-port transhipment were similarly economical; according to best practice, the vessel should have transshipped in port.
Less than 0.8	High seas transhipment was likely more economical than in-port transhipment.

Either of the distance ratios indicates the economics of travel distance for transhipment, and therefore, the greater ratio may be used to make the argument. However, we note that the determination of the centre of the fishing area contains arguable uncertainty due to subjectivity and complicated tracks. This applies to the manual estimation of the centre and its automated calculation as discussed in the section *Summary statistics of journey metrics*.

We recommend that practitioners in WCPFC member flag states apply this proposed method and evaluate its suitability. We expect that feedback based on their experience will result in modifications and refinements of the interpretations.

6 Discussion

As discussed in the introduction, WCPFC Members are mandated by CMM 2009–06 to determine if in-port transhipment is impracticable for a certain vessel and submit a plan describing the measures to promote transhipment in port. The CMMs established two general principles that define impracticability: significant economic hardship and historical method of operation.

6.1 Significant economic hardship

First, there must be significant economic hardship due to the restriction on high seas transhipment based on the cost incurred to tranship or land fish at permitted locations other than on the high seas.

Fuel is the single most important operational cost across all fleets, subject to the most significant fluctuations across all cost categories and, hence, a major determinant in the change in fishing costs over time (FFA 2022)[11]. Skirtun (*pers comm 2024*[12]) assesses that fuel makes up, on average, 30% of operational costs, with variability depending on the age and condition of the vessel. Based on this assessment, our study assumes that the critical component for economic hardship is based on the cost of fuel and that fuel consumption is directly correlated to distances travelled.

We recognise that if catch rates are high, then the economics of fishing could compensate for the impact of fuel costs, yet the FFA (FFA 2022) informs that catch rates in the longline fleet have been falling since 2014.

Only in 2019, small increases in catch rates and reductions in fuel costs (due to Covid 19) saw the economic conditions remain stable despite declining fish prices. Between 2020 and 2021, the financial index marginally declined in 2020 before falling significantly to its second lowest recorded level in 2021 as fish prices and catch rates fell and fuel costs increased. Therefore, for the time range in this study, the cost of fuel and the distances to be travelled by longliners would be the key economic factors in determining hardship.

The distance travelled for transhipment is one activity contributing to the expenses related to time and fuel consumption of longline tuna fishing by distant water fishing vessels. Other major journey components include transit from and to home ports, transits between fishing areas, and tracks steamed during active fishing. Therefore, an argument of economic hardship of travelling 500 - 1000 NM to a transhipment port should be evaluated relative to home transits (~5000 NM) and actual fishing activity. We recommend that further work be dedicated to quantifying these journey components.

The discussions and references to economic hardship in the CMM should also consider the expenses incurred by carriers, which are part of the transhipment definition. While at sea, carriers use their primary propulsion engines to face the wind and waves during transhipment and throughout idling times. In contrast, when moored in port, the main engines are turned off, and only generators for electricity and refrigeration systems are turned on, resulting in a significant decrease in fuel consumption.

Even though Taiwan,[13] Korea,[14] Japan[15] and China[16] all have emissions trading schemes in place, they do not apply to emissions from shipping, which would result in even higher fuel costs. Neither carrier economics nor the exemption from carbon emission accounting are considered when

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[11] FFA (2022). *Economic and Development Indicators and Statistics Tuna Fisheries of the Western and Central Pacific Ocean 2022* *https://www.ffa.int/download/economic-development-indicators-and-statistics/*

[12] Maggie Skirtun (2024). Personal comments from "Review of the financial and economic performance of the Fijian offshore longline fishery" in press

[13] https://focustaiwan.tw/business/202310150003#

[14] https://icapcarbonaction.com/en/ets/korea-emissions-trading-scheme

[15] https://japancredit.go.jp/english/

[16] https://chineseclimatepolicy.oxfordenergy.org/book-content/domestic-policies/emissions-trading

determining economic hardship. While not a specific objective of this study, we provide insights into carrier vessel journeys. We recommend future research into journeys of carrier vessels and the economics of maintaining a waiting position compared to being anchored at port.

6.1.1 Historical method of operation

Second, the ship must alter its historical method of operation in a way that is significant and substantial to comply with the prohibition on transhipment on the high seas. This condition may be met for vessels that choose to operate in fishing areas that are remote from suitable transhipment ports where carrier vessels provide a significantly more economical way to offload catch. However, arguments based on historical operational practices are more problematic to scrutinise as they require a largely qualitative analysis of activity records over many years.

6.2 Port-related costs

This study does not investigate the costs and charges incurred by vessels and their cargo in ports. The terms for these charges differ between ports in the region, but typically include fees for agents, pilots, port access and use rates (generally based on the gross registered tonnage of the vessel), charges related to boarding and inspection by immigration, customs, biosecurity, quarantine, fisheries officers, and volume-based transhipment fees.

Port-related costs are not directly specified in the CMM but are inherent to the economic hardship argument. Skirtun (*pers. comm.*) projects for the Fiji-based longline fleet that combined charges for a fishing licence and customs vary between 2 and 5%. Therefore, we consider port charges to be a minor component of vessel economics concerning impracticability.

Nevertheless, to counter arguments from vessel operators regarding the cost of in-port transhipment, ports in the region may consider incentivising the entry of longliners by offering a reduced tariff structure. Policy development for incentives could be aligned with the environmental impact assessment of incoming cargo vessels in many ports worldwide.

The port of Nelson in New Zealand, for example, is an Environmental Ship Index Incentive Provider, offering progressive discount rates for vessels based on their Environment Ship Index Score[17]. A similar regionally agreed approach based on compliance and/or frequency of visits could be applied to reduce port costs. This model could also be applied to the annual licensing costs for carriers to operate in FFA member's EEZs.

Wold (2018) informs that the lack of ultra-low temperature (ULT) facilities (those capable of freezing to -50 to -35˚C) in some Pacific ports has been used as an excuse for distant-water fishing operators not to come to port. However, this lack of capacity should not affect transhipment since if the fish is being "transhipped", then, by definition, it is not being landed to be in ULT cool stores. It is important to note that the FAO Voluntary Guidelines of Transhipment[18] are consistent with the WCPFC definition. Furthermore, the transhipment of ULT fish between vessels is easier and safer in the protected water of a port rather than in the open seas where ULT fish is more exposed to weather events and rain.

It is important to note at this stage that increasing port usage by longliners has positive impacts on other areas, such as supporting crew labour rights, maintaining electronic monitoring hardware, pollution prevention, and bycatch assessment. Details on each of these aspects are presented in Appendix C.

6.3 The case for an independent High Seas Transhipment Observer Programme

Other tuna regional fisheries management organisations (RFMOs) confronted with similar scenarios established independent observer programmes for high-seas transhipments in areas beyond

[17] https://www.environmentalshipindex.org/

[18] https://www.fao.org/iuu-fishing/resources/detail/en/c/1638082/

reasonable port access. The 15th regular session of the WCPFC in 2018 recognised the need to improve transhipment oversight and formed an intercessional working group (IWG) to study the effectiveness of its current transhipment measure CMM 2009-06. A key question included in the scope of work of the IWG reads: *What are the benefits, limitations, and estimated costs to WCPFC of implementing a regional observer program specifically for carrier vessels, managed and administered by an independent organisation similar to transhipment observer programs in the Indian Ocean Tuna Commission (IOTC), International Commission for the Conservation of Atlantic Tunas (ICCAT), and Inter-American Tropical Tuna Commission (IATTC)?*.

Currently, WCPFC requires 100% Regional Observer Programme (ROP) observer coverage to monitor at-sea transhipment (CMM 2009-06 paragraph 13). However, the WCPFC is the only tuna RFMO still needing to create a dedicated independent high-seas transhipment observer program for receiving carriers. Some WCPFC members provide observer coverage on their flagged vessels under national observer programmes. However, due to the lack of Commission-wide standards for observer training, data collection, and reporting, regionally consistent information cannot be derived from these programmes.

Other tuna RFMOs such as IOTC, ICCAT, IATTC, and, to a certain extent, the Commission for the Conservation of Southern Bluefin Tuna (CCSBT) have comparable transhipment measures that apply to large tuna longline fishing vessels and authorised carrier vessels. Each measure requires that:

- All at-sea transhipments are prohibited unless monitored under the transhipment ROP;
- Members ensure that all carrier vessels have a transhipment ROP observer onboard; and
- Members submit an annual comprehensive report assessing the content and conclusions of the observers' reports assigned to their carrier vessels.

Across the tuna RFMOs, these measures have led to similar high-seas transhipment ROPs financed by countries whose longline vessels engage in transhipment operations but are managed and administered by independent organisations. These third-party organisations have provided training, coordinated placements, debriefed observers, and reported on transhipment data for over a decade. A comparison table of their structure and costs is attached in Appendix D.

It is unclear why CMMs support regional observer programmes in other tuna RFMOs but not in the WCPFC.

7 Conclusions and policy recommendations

This study identifies a range of behavioural patterns of longline vessels in the western central Pacific Ocean. Some of the behaviours identified challenge any notion that the WCPFC CCM involved in high seas transhipment carry out the expected due diligence as mandated by CMM 2009–06 to determine if in-port transhipment is impracticable for a particular vessel.

Our detailed track analysis revealed that journey characteristics between vessels are diverse, and typical distances to rendezvous points and ports vary significantly. Additionally, the network analysis identifies distinct relationships between groups of fishing vessels and carrier vessels. Furthermore, our findings suggest repeated port avoidance by many vessels licensed to fish in the waters of some FFA members. This suggests that decisions to favour high-seas transhipment over port calls are made for groups of vessels. If true, this practice would be against the transhipment CMM (CMM 2009–06).

At this point, we note that the transhipment notification procedure is only required for catch-related transfers. This leaves a loophole in the regulations, allowing vessels to circumvent the requirement for a justification of impracticality. Fishing vessels with beneficial relationships with carrier vessels and across the industry may expend additional fuel to avoid calls to ports with Port State Measures (PMA) to transfer logistics, and this provides an opportunity to move unreported fish to their carrier without WCPFC notification. Such activities would be challenging to detect by flag or port states with lower maritime control and surveillance capacity, and some ports outside the Pacific may not verify the nature of those transfers via PSM procedures as the carriers are flagged domestically.

For example, after fishing closer to ports, many licensed longliners fishing in PNG travel longer distances to tranship in the high seas pocket rather than to come to port. This could inform the licensing arrangements in PNG to promote transhipment in, e.g., Rabaul and Kavieng instead of passing them by on long journeys to the high seas. Port Moresby, while not directly on route, could be promoted for those fishing in the southern waters.

As PNG and the Solomon Islands have declared their intent to become parties to the FAO Port State Measures Agreement (PSMA), vessels could also be required to consider Noro, a well-protected and serviced port in the Solomon Islands, as an alternative to tranship.

For ports such as Kosrae (FSM), Funafuti (Tuvalu) and Tarawa (Kiribati), the median distance that vessels travel for high-seas transhipment and the distance to the nearest suitable port is similar and, in all cases, below 500 NM.

An argument can be presented that the economic hardship of the transit to tranship is at least equivalent to that of travelling to port. Additionally, ports provide other compliance and labour rights benefits. Consequently, there may be no valid reason for those vessels not to come to port. A similar scenario could be applied for those vessels fishing in the northern part of the Line Islands group in Kiribati, on a radius of 400 NM around Kiritimati Island.

In several cases, high-seas transhipment events appear more economical than in-port transhipments, even though the fishing vessel was active in an FFA member state’s EEZ. For example, the Cook Islands see substantial fishing inside the northern part of their EEZ followed by transhipments outside their EEZ in the north. We suggest continuing with the two established options for addressing the economic hardship argument in such cases. First, the Cook Islands may provide access to a transhipment base in one of the lagoons on the islands of the northern groups. Second, the Cook Islands may re-evaluate having representation again in Pago Pago (American Samoa) or a memorandum of understanding under the FFA PSM framework with Apia (Samoa), which had been the operational port Cook Islands-flagged or licensed vessels.

For longliners fishing exclusively in the high seas, operators and masters freely choose the fishing ground, thus if this decision involves expenditures to maintain compliance levels similar to the rest of the fleet, these costs should be seen as part of the business.

The lack of oversight of high-seas transhipments has been solved in all other tuna RFMOs with independent ROPs. While most FFA members have preferred prohibiting all high sea transhipments as per CMM 2009-06 wording, the practice remains authorised under the impracticability exemption.

A range of practical potential reforms are available to improve transhipment oversight, primarily through strengthening the existing observer reporting processes and programs. As such, it is recommended that if vessels choose to fish in areas of the high seas that justify the impracticability exemption in terms of economic hardship and historical method of operation, they should operate under an observer programme similar to those their vessels comply with in all other tuna RFMOs or come to tranship at any port in the region.

In conclusion, despite observer coverage on carrier vessels transhipping in the WCPFC (CMM 2009-06), IUU quantification studies (FFA, 2021) still indicate that transhipment at sea is one of the higher risk activities for facilitating IUU activity.

Therefore, we suggest that the TS IWG considers our findings in its review of the measure and recommends further revisions to the transhipment CMM to WCPFC21, addressing the issues we discussed.

8 List of attachments

- Attachment: WCPFC_hs_transhipment_events.csv
- Attachment: WCPFC_hs_fishing_vessels.csv
- Attachment: WCPFC_hs_carrier_vessels.csv
- Attachment: transhipment_network.html
- Attachment: FFA_transhipment_ports.json

9 Appendix A: List of fishing vessels involved in transhipments

Fishing vessels involved in transhipments in our dataset. The vessels are shown in descending order of the number of transhipment events (TS). Full details are provided in Attachment *WCPFC_hs_fishing_vessels.csv*.

MMSI	IMO	Name	Flag	TS	Registered owner
440765000	8619247	207 Dong Won	South Korea	9	Dongwon Industries Co Ltd
416000301	8791928	Man Fu Tsai No11	Taiwan	9	Syu H-P
412420239	9619256	Ptr31	China	8	Pingtairong Ocean Fishery
416004214	8777752	Jin De Man No1	Taiwan	8	Lin YC
416001037	8537463	Tenn Fa Li No8	Taiwan	8	Chen CP
412985000	8651233	Xin Shi Ji 7	China	7	Zhejiang Ocean Fisheries Group
412679210	8651269	Xin Shi Ji 17 Hao	China	7	Zhejiang Ocean Fisheries Group
441650000	9047893	377 Oryong	South Korea	7	Sajo Industries Co Ltd
440620000	8843111	212 Dong W0n	South Korea	7	Dongwon Industries Co Ltd
440574000	9042013	No.208 Dongwon	South Korea	7	Dongwon Industries Co Ltd
416122800	7513953	Chin You Wen	Taiwan	7	Chin You Wen Fishery
416006326	9911006	Man Yu Cai No6	Taiwan	7	Tsai T-I
412993000	8651271	Xin Shi Ji87	China	6	Zhejiang Ocean Fisheries Group
412549463	9671761	Rong Heng 41	China	6	Zhoushan Rongyourong Ocean
412549462	9671759	Rong Heng 19	China	6	Zhoushan Rongyourong Ocean
412549222	9903619	Liaoyuanyu103	China	6	Liaoning Kimliner Ocean
412549221	9903607	Liaoyuanyu101	China	6	Liaoning Kimliner Ocean
440963000	8815645	No.101 Hae Cheon	South Korea	6	Sea Sky Mulsan Co Ltd
440919000	8703854	501 Nam Gung	South Korea	6	3T Ocean Co Ltd
440339000	8619261	No.509namgung	South Korea	6	3T Ocean Co Ltd
416222700	8787757	Jin Hung Man	Taiwan	6	Hung C-Y
416123900	8651403	Hung Seng	Taiwan	6	Chin Horng Fishery Co Ltd
416086600	8651489	Hong An No.2	Taiwan	6	Shuo Long Fishery Co Ltd
416004409	8778392	Yi Rong No3	Taiwan	6	Lee K-C
576699000	9004281	Boada No5	Vanuatu	6	Boada Fishery Co Ltd
412549464	9671785	Rong Heng 49	China	5	Zhoushan Rongyourong Ocean
412549105	9891983	Lurongyuanyu357	China	5	Rongcheng Ocean Fishery Co Ltd
412421188	9861433	Zhouyuanyu2606	China	5	Zhoushan Haihong Ocean Fishery
412420863	9702912	Hai Xing 815	China	5	Zhoushan Haixing Ocean
412420435	8654194	Haixing717	China	5	Zhoushan Haixing Ocean
441660000	9020106	No.3 Kyung Yang	South Korea	5	Kyung Yang Fisheries Co Ltd
440788000	8717817	Dong Won No.205	South Korea	5	Dongwon Industries Co Ltd
440780000	8905567	No.621 Dong Won	South Korea	5	Dong Won Fisheries Co Ltd
440772000	8714061	82 Agnes	South Korea	5	Agnes Fisheries Co Ltd
440648000	8821565	Tonina 3	South Korea	5	Dongwon Industries Co Ltd
440646000	8610631	No.803 Dongwon	South Korea	5	Dongwon Industries Co Ltd
440645000	9001423	Tonina5	South Korea	5	Dongwon Industries Co Ltd
440604000	8714231	Shinyung.No.51	South Korea	5	Silla Co Ltd

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440595000	8916358	Panalox No.501	South Korea	5	Silla Co Ltd
440584000	8714126	No.201dongwon	South Korea	5	Dongwon Industries Co Ltd
440504000	8619326	No.56 Shin Yung	South Korea	5	Silla Co Ltd
416222500	8777788	Maan Yih Feng No266	Taiwan	5	Liang J-P
416214700	8551536	Her Hae	Taiwan	5	Kung K-T
416195900	8791241	Man Yi Feng No.66	Taiwan	5	Chern JH
416176700	9386835	Ying Rong No 638	Taiwan	5	Ying Rong Fishery Co Ltd
416142600	8629254	Yang_Shun_No.8	Taiwan	5	Yang Shun Fishery Co Ltd
416120500	9198147	Shang Shun No.622	Taiwan	5	Shang Yuin Fishery Co Ltd
416005715	9876232	Chi Fa No.1888	Taiwan	5	Hsin Jyi Fa Fishery Co Ltd
416003413	8551495	Her Hae No 26	Taiwan	5	Jheng B-S
416002825	8791851	Man Fu Tsai No88	Taiwan	5	Wang H-L
416002195	8794889	Yi Rong No.16	Taiwan	5	Li M-S
416000476	8791239	Maan Yih Feng No26	Taiwan	5	Liang TC
577319000	8821072	Grand East	Vanuatu	5	Grand East Fishery Co Ltd
413404430	8797386	Zhouyuanyu202	China	4	Zhoushan Haihong Ocean Fishery
412549104	9891971	Lurongyuanyu356	China	4	Rongcheng Ocean Fishery Co Ltd
412421156	9861421	Zhouyuanyu2605	China	4	Zhoushan Haihong Ocean Fishery
412420911	9775866	Xin Shi Ji 207	China	4	Zhoushan Pacific Tuna Pelagic
412371207	9784740	Hu Yu 928	China	4	Shanghai Deep Sea Fisheries
412329417	8669113	Lurongyuanyu589	China	4	Rongcheng Mashan Ocean
412326881	9678355	Zhongrong 33	China	4	Rongcheng Ocean Fishery Co Ltd
412200115	8647517	Sunstar6	China	4	Dalian Jinguang Fishery Co Ltd
441584000	9152179	375 Oryong	South Korea	4	Sajo Industries Co Ltd
441524000	9036715	650dong Won	South Korea	4	Dong Won Fisheries Co Ltd
441233000	8804062	355oryong	South Korea	4	Sajo Industries Co Ltd
441043000	9012331	Agnes 83	South Korea	4	Agnes Fisheries Co Ltd
440989000	8703440	353 Oryong	South Korea	4	Sajo Industries Co Ltd
440986000	9042037	316oryong	South Korea	4	Sajo Industries Co Ltd
440935000	8815695	718-Oryong	South Korea	4	Sajo Industries Co Ltd
440934000	8717879	716 Oryong	South Korea	4	Sajo Industries Co Ltd
440900000	8815669	No.618dongwon	South Korea	4	Dong Won Fisheries Co Ltd
440858000	8717805	Dong Won No.203	South Korea	4	Dongwon Industries Co Ltd
440821000	8717855	No.1 Chil Sung	South Korea	4	Hansung Enterprise Co Ltd
440731000	8714188	315 O Ryong	South Korea	4	Sajo Industries Co Ltd
440704000	8717867	Oryong 715	South Korea	4	Sajo Industries Co Ltd
440590000	8717843	No.38 Hansung	South Korea	4	Hansung Enterprise Co Ltd
440549000	8916384	Panalox505	South Korea	4	Silla Co Ltd
440503000	8815724	No55shinyung	South Korea	4	Silla Co Ltd
440298000	8827741	No.517 Namgung	South Korea	4	3T Ocean Co Ltd
440045000	9042049	Oryong No.317	South Korea	4	Sajo Seafood Co Ltd
416623000	8647414	Chin Yung Wen	Taiwan	4	Chin Yung Wen Fishery Co Ltd

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416503000	8649060	Lung Soon No 126	Taiwan	4	Lung Fa Fishery Co Ltd
416245700	8791899	Man Fu Tsai No.5	Taiwan	4	Chern W-S
416237600	8778407	Yi Rong No.6	Taiwan	4	Lee M-T
416236600	8782460	Fwu Maan No.88	Taiwan	4	Wu B-S
416235700	8649034	Yu Feng No.513	Taiwan	4	Chang M-H
416235600	8777881	Yu Shun No.2	Taiwan	4	Lee Y-T
416232500	8947230	Chin You Ming	Taiwan	4	Chin You Ming Fishery Co Ltd
416230800	8777829	Sing Man Yi No.3	Taiwan	4	Hsu Y-C
416208900	8782886	Chu Huai No.628	Taiwan	4	Tsai R-J
416127500	8782915	Li Cheng No.28	Taiwan	4	Hsu C-T
416008800	8652304	Hong Yi	Taiwan	4	Huang Ming Fishery Co Ltd
416004662	8795338	De Chan	Taiwan	4	Kuo J-C
416004421	8532358	Lian Sheng No.168	Taiwan	4	Lin K-M
416004248	8748804	Chang Yi No368	Taiwan	4	Hung J-C
416004043	8523917	Shenglian Shiang No1	Taiwan	4	Tseng F-S
416002922	8530013	Hai Chien Hsing No2	Taiwan	4	Lin H-Y
416002274	8777324	Chu Huai No 668	Taiwan	4	Shun Rong Fishery Co Ltd
412460299	9042661	Shen Gang Shun 2	China	3	Shengang Overseas Industrial
412421199	9861457	Zhouyuanyu2608	China	3	Zhoushan Haihong Ocean Fishery
412421098	9755799	Dongyu1527	China	3	Zhejiang Xingpeng Ocean
412420915	9775892	Xin Shi Ji 210	China	3	Zhoushan Pacific Tuna Pelagic
412420906	9727792	Hai Xing 616	China	3	Zhoushan Haixing Ocean
412420793	9663582	Xinshiji 202	China	3	Zhejiang Ocean Fisheries Group
412371206	9784738	Huyu927	China	3	Shanghai Deep Sea Fisheries
412329416	9700366	Lurongyuanyu326	China	3	Rongcheng Mashan Ocean
441812000	8734267	No.7 Kyung Yang	South Korea	3	Kyung Yang Fisheries Co Ltd
441481000	9020118	Hae Cheon 808	South Korea	3	Sea Sky Mulsan Co Ltd
441439000	9895850	No 901 Oryong	South Korea	3	Sajo Industries Co Ltd
441098000	8905593	No 355 Oyang	South Korea	3	Oyang Corp
440954000	8911322	No.632 Dong Won	South Korea	3	Dong Won Fisheries Co Ltd
440944000	8510582	Agnes 95	South Korea	3	Agnes Fisheries Co Ltd
440941000	8714176	No.202 Hae Cheon	South Korea	3	Sea Sky Mulsan Co Ltd
440936000	8829543	Oryong No 722	South Korea	3	Sajo Industries Co Ltd
440931000	9041112	733 Oryong	South Korea	3	Sajo Industries Co Ltd
440894000	8911334	No.633 Dongwon	South Korea	3	Dong Won Fisheries Co Ltd
440885000	9019315	Oryong No.723	South Korea	3	Sajo Industries Co Ltd
440820000	8619388	No.36hansung	South Korea	3	Hansung Enterprise Co Ltd
440809000	8815671	619 Dongwon	South Korea	3	Dong Won Fisheries Co Ltd
440807000	8815683	O Ryong No.717	South Korea	3	Sajo Industries Co Ltd
440787000	8821503	No.707 Haecheon	South Korea	3	Sea Sky Mulsan Co Ltd
440770000	9042025	No.90agnes	South Korea	3	Agnes Fisheries Co Ltd
440751000	8714102	No518namgung	South Korea	3	3T Ocean Co Ltd

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440733000	8703880	306 Oryong	South Korea	3	Sajo Industries Co Ltd
440699000	8921250	No.11 Hae Cheon	South Korea	3	Sea Sky Mulsan Co Ltd
440647000	8610629	No.9 Kyung Yang	South Korea	3	Kyung Yang Fisheries Co Ltd
440617000	8916360	Panalox 502	South Korea	3	Silla Co Ltd
440612000	8717984	Shinyung No.52	South Korea	3	Silla Co Ltd
440522000	8916396	Panalox 506	South Korea	3	Silla Co Ltd
440125000	9031868	No.313 Dae Hwa	South Korea	3	Dae Hae Fisheries Co Ltd
440055000	9019509	Oryong 325	South Korea	3	Sajo Seafood Co Ltd
416349000	8648626	Shang Shun 168	Taiwan	3	Lung Yuin Fishery Co Ltd
416251500	9826029	De Chan No.116	Taiwan	3	Kuo Chen YY
416231600	8777910	Yu Shun	Taiwan	3	Lin H-C
416230900	8790338	Chuan I Shin	Taiwan	3	Tsai M-C
416221900	8794736	Cheng Jhan Hsiang	Taiwan	3	Hung Chen L-C
416219700	8777805	Ming Maan Shyang 86	Taiwan	3	Hung H-S
416218600	8791875	Man Fu Tsai No.168	Taiwan	3	Tsai C-L
416213800	8777386	Chuan Hsin No.128	Taiwan	3	Tsai H-M
416211600	8781179	Chiuanfacheng No166	Taiwan	3	Hung Y-S
416196600	8526086	Man Yih Feng No166	Taiwan	3	Chern S-T
416127800	8782927	Li Hung No868	Taiwan	3	Wang C-C
416079500	8341319	Chao Yi No368	Taiwan	3	Lin K-H
416075900	8791863	Man Fu Tsai No9	Taiwan	3	Chen C-H
416005482	9850939	Shun Sheng No.588	Taiwan	3	Shun Sheng Fishery Co Ltd
416005370	9832614	Lian Sheng No.369	Taiwan	3	Yong Sheng Fishery Co Ltd
416004049	8795479	Ching Cheng Fu No66	Taiwan	3	Chen Y-P
416003658	8778445	Man Fu Long	Taiwan	3	Lin T-S
416003534	8783737	Shin Jaan Shin No368	Taiwan	3	Chen J-S
416002859	8540604	Sheng I Tsia No268	Taiwan	3	Chen H-J
416002731	8778469	Yu Long No.2	Taiwan	3	Kung Y-L
416002586	8777398	Chuan Shyang No98	Taiwan	3	Tsai I-C
416002548	8790819	Shin Jaan Shin	Taiwan	3	Chen S-D
416002469	8777374	Chuan Hsiang No368	Taiwan	3	Tsai C-T
416001084	8793720	Line Yi Hsing No12	Taiwan	3	Chai M-J
416000461	8540173	Jin Sing Shyang No13	Taiwan	3	Chen C-J
413011000	8676049	Jing Yuan 903	China	2	Yantai Beijing Deep-Ocean
412674190	9971161	Xin Shi Ji 36	China	2	Zhejiang New Times Fisheries
412549293	9923633	Ping Tai Rong 319	China	2	Pingtairong Ocean Fishery
412549262	9918078	Lu Ru Yuan Yu 118	China	2	Weihai Hengyuan Fisheries Co
412463903	9804370	Zhong Yang 23	China	2	Shenzhen Shuiwan Pelagic
412421288	9861445	Zhouyuanyu2607	China	2	Zhoushan Haihong Ocean Fishery
412421095	8683145	Dong Yu 1521	China	2	Zhejiang Xingpeng Ocean
412421094	8672249	Dongyu1530	China	2	Zhejiang Xingpeng Ocean
412420914	9775880	Xin Shi Ji 209	China	2	Zhoushan Pacific Tuna Pelagic

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412420913	9775878	Xin Shi Ji 208	China	2	Zhoushan Pacific Tuna Pelagic
412420898	9861392	Zhouyuanyu2601	China	2	Zhoushan Haihong Ocean Fishery
412420893	8672225	Xin Shi Ji 158	China	2	Zhejiang New Times Fisheries
412420891	9727481	Xinshiji215	China	2	Zhoushan Haixing Ocean
412420862	8672237	Xin Shi Ji 216	China	2	Zhoushan Pacific Tuna Pelagic
412420851	8668664	Feng Hui 17	China	2	Zhejiang Fenghui Ocean
412420849	8668652	Feng Hui 8	China	2	Zhejiang Fenghui Ocean
412420847	8668638	Feng Hui 6	China	2	Zhejiang Fenghui Ocean
412420812	9676759	Pingtairong55	China	2	Pingtairong Ocean Fishery
412420811	9676747	Pingtairong50	China	2	Pingtairong Ocean Fishery
412420436	8654209	Hai Xing 718	China	2	Zhoushan Haixing Ocean
412420237	8628781	Pingtairong39	China	2	Pingtairong Ocean Fishery
412420236	8628810	Pingtairong9	China	2	Pingtairong Ocean Fishery
412371208	9784673	Hu Yu 929	China	2	Shanghai Deep Sea Fisheries
412354265	8690112	Yuan You 816	China	2	Jiangsu Yuan You Pelagic
412333795	8797946	Lurongyuanyu659	China	2	Shandong Shawodao Ocean
412333794	8797934	Lurongyuanyu658	China	2	Shandong Shawodao Ocean
412333792	8797910	Lurongyuanyu558	China	2	Shandong Shawodao Ocean
412329433	9699696	Lurongyuanyu789	China	2	Shandong Shawodao Ocean
412329429	9699660	Lurongyuanyu769	China	2	Shandong Shawodao Ocean
412329428	9699658	Lurongyuanyu768	China	2	Shandong Shawodao Ocean
412326882	9678343	Zhong Rong 32	China	2	Rongcheng Ocean Fishery Co Ltd
412326877	9678331	Rongtai8	China	2	Rongcheng Mashan Ocean
412326873	9666948	Hong Yang 88	China	2	Rongcheng Ocean Fishery Co Ltd
441427000	8909616	No.503 Namgung	South Korea	2	Three T Ocean Co Ltd
441341000	8808159	No.22 Hae Cheon	South Korea	2	Sea Sky Mulsan Co Ltd
441084000	8920892	371 O Yang	South Korea	2	Oyang Corp
441018000	8920907	372 Oyang	South Korea	2	Oyang Corp
440992000	8821553	Atun Tres	South Korea	2	Dongwon Industries Co Ltd
440987000	8714164	311 Oryong	South Korea	2	Sajo Industries Co Ltd
440966000	8911308	No202daehwa	South Korea	2	Dae Hae Fisheries Co Ltd
440933000	8709092	Oryong No 708	South Korea	2	Sajo Industries Co Ltd
440895000	8911310	No631dongwon	South Korea	2	Dong Won Fisheries Co Ltd
440871000	8911293	No.201 Daehwa	South Korea	2	Dae Hae Fisheries Co Ltd
440847000	8714047	No.303 Daehwa	South Korea	2	Dae Hae Fisheries Co Ltd
440846000	8703892	No.303 Hae Cheon	South Korea	2	Sea Sky Mulsan Co Ltd
440801000	8716057	No.101 Sojin	South Korea	2	Sea Sky Mulsan Co Ltd
440792000	8619364	Oryong No 707	South Korea	2	Sajo Industries Co Ltd
440786000	8805327	No.308daehwa	South Korea	2	Dae Hae Fisheries Co Ltd
440781000	8905581	No.623 Dongwon	South Korea	2	Dong Won Fisheries Co Ltd
440773000	8805315	No.2 Kyungyang	South Korea	2	Kyung Yang Fisheries Co Ltd
440636000	8714023	No.617 Dongwon	South Korea	2	Dong Won Fisheries Co Ltd

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440628000	8815712	No.21 Kyungyang	South Korea	2	Kyung Yang Fisheries Co Ltd
440246000	8703842	No.502 Namgung	South Korea	2	3T Ocean Co Ltd
440239000	9046409	No.39hansung	South Korea	2	Hansung Enterprise Co Ltd
416631000	8749456	Chien Chang 36	Taiwan	2	Jien Tsuen Ocean Enterprise
416342000	9223576	Chien Chang No.226	Taiwan	2	Chien Chang Enterprise
416242800	9700108	Chi Hsiang No.889	Taiwan	2	Lin T-H
416230600	8777702	Yu Shun No.8	Taiwan	2	Lee W-Y
416229600	8651142	De Yu No26	Taiwan	2	Sheng I Tsai Fishery Co Ltd
416210600	8777831	Sing Man Yi N0.6	Taiwan	2	Chen H-C
416199500	8530673	Jin Fu Yi	Taiwan	2	Cehn C-H
416198500	8526062	Yu Long Fa No36	Taiwan	2	Hung C-J
416120600	9190652	Lung Soon No282	Taiwan	2	Chang Shun Fishery Co Ltd
416119900	9184005	Lung Soon No212	Taiwan	2	Hong Lung Fishery Co Ltd
416076700	8787290	Ming Tsair Fa No10	Taiwan	2	Sheu J-M
416006662	9917309	Yong Fu Fa No 18	Taiwan	2	Chien C-T
416005836	9886665	Hung Wen No.322	Taiwan	2	Chang Yu Fishery Co Ltd
416005826	9887138	Hsing Man Yi No2	Taiwan	2	Zhong Yi Fisheries Co Ltd
416004887	8795431	De Chan No.44	Taiwan	2	Guo S-F
416004411	8540616	Sheng I Tsai No. 868	Taiwan	2	Huang C-P
416004098	8550635	Jin Hung Cheng	Taiwan	2	Hung C-Y
416004084	8783713	Te Yun No.16	Taiwan	2	Ling T-F
416003874	8786179	Jin Fu Fong	Taiwan	2	Lee C-C
416003677	8530776	Shun Wen Fa 168	Taiwan	2	Chen Y-C
416003472	8551483	Her Hae No.38	Taiwan	2	Wang W-F
416002858	8545410	Sheng I Tsai No.368	Taiwan	2	Huang M-J
416002783	8526050	Yu Long Fa No22	Taiwan	2	Hung P-C
416002682	8540575	Sheng Yi Cai No33	Taiwan	2	Huang Li Y-Y
416002591	8792659	Li Hung No.666	Taiwan	2	Chen Y-C
416002581	8526074	Yu Long Fa No.168	Taiwan	2	Hong J-L
416002492	8530714	Maanhsingchyuu No36	Taiwan	2	Lin C-H
416002441	8777726	Hai Chien Hsing	Taiwan	2	Ni H-L
416002143	8778421	Fu Long Shun	Taiwan	2	Kung Y-L
416002116	8777843	Sing Man Yi	Taiwan	2	Chen H-C
416000833	8793524	Hung Long	Taiwan	2	Deng C-Y
416000381	8550269	Lian Horng Fa	Taiwan	2	Huang J-F
577290000	9004451	Essien No.108	Vanuatu	2	Belegaer Fiskery Co Ltd
577146000	8520056	Glory No.8	Vanuatu	2	Forever Fishery Co Ltd
576872000	8977027	Ocean Harvest	Vanuatu	2	Ocean Harvest Fishery
576850000	8947462	Yi Shun No.102	Vanuatu	2	Yi Fa Fishery Co Ltd
576737000	8970794	Da Wen	Vanuatu	2	Da Wen Fishery Co Ltd
413204950	9813929	Shun Da 9	China	1	Dalian Jinguang Fishery Co Ltd

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412695650	8670033	Xinshiji80	China	1	Zhejiang Ocean Family Co Ltd
412695640	8653530	Xin Shi Ji 79	China	1	Zhejiang Ocean Family Co Ltd
412695590	8649474	Xin Shi Ji 75	China	1	Zhejiang Ocean Family Co Ltd
412695550	8653475	Xinshiji70	China	1	Zhejiang Ocean Family Co Ltd
412549384	9946489	Lupengyuanyu 069	China	1	Penglai Jing Lu Fisheries Co
412549378	9951707	Ping Tai Rong 688	China	1	Pingtairong Ocean Fishery
412549263	9918080	Luruyuanyu138	China	1	Weihai Hengyuan Fisheries Co
412463904	9804368	Zh0ng Yang 22	China	1	Shenzhen Shuiwan Pelagic
412463901	9804344	Zhongyang12	China	1	Shenzhen Shuiwan Pelagic
412460061	9671747	Zhong Yang 16	China	1	Shenzhen Shuiwan Pelagic
412421097	8791502	Ping Tai Rong 301	China	1	Pingtairong Ocean Fishery
412420905	9727780	Haixing615	China	1	Zhoushan Haixing Ocean
412420892	8672213	Xinshiji 157	China	1	Zhejiang New Times Fisheries
412420865	9702936	Haixing817	China	1	Zhoushan Haixing Ocean
412420852	8668676	Feng Hui18	China	1	Zhejiang Fenghui Ocean
412420848	8668640	Feng Hui 7	China	1	Zhejiang Fenghui Ocean
412420814	9676773	Pingtairong60	China	1	Pingtairong Ocean Fishery
412420813	9676761	Pingtairong58	China	1	Pingtairong Ocean Fishery
412420796	9663611	Xin Shi Ji206	China	1	Zhejiang Ocean Fisheries Group
412420794	9663594	Xin Shi Ji 203	China	1	Zhejiang Ocean Fisheries Group
412420792	9663570	Xin Shi Ji 201	China	1	Zhejiang Ocean Fisheries Group
412420596	8668523	Dong Yu 1518	China	1	Zhejiang Industrial Group
412420584	9655078	Pingtairong29	China	1	Pingtairong Ocean Fishery
412420434	8654182	Hai Xing 716	China	1	Zhoushan Haixing Ocean
412420433	8654170	Hai Xing 715	China	1	Zhoushan Haixing Ocean
412370007	9009035	Hai Shang38	China	1	Shanghai Jinyou Deepsea
412354267	8689436	Yuang You 616	China	1	Jiangsu Yuan You Pelagic
412354266	8690100	618	China	1	Jiangsu Yuan You Pelagic
412354264	8690356	Yuanyou818	China	1	Jiangsu Yuan You Pelagic
412336913	9878618	Lurongyuanyu900	China	1	Rongcheng Ocean Fishery Co Ltd
412336911	9871969	Lurongyuanyu686	China	1	Rongcheng Ocean Fishery Co Ltd
412331499	9834246	Lurongyuanyu297	China	1	Rongcheng Mashan Ocean
412331028	9748514	S% Rong Yuan Yu 819	China	1	Qingdao Furui Fisheries Co Ltd
412329431	9699672	Lurongyuanyu778	China	1	Shandong Shawodao Ocean
412329427	9699646	Lurongyuanyu758	China	1	Shandong Shawodao Ocean
412328793	8661721	Runda3	China	1	Rongcheng Ocean Fishery Co Ltd
412328792	9702950	Runda5	China	1	Rongcheng Runda Fisheries
412328728	8663353	Lurongyuanyu328	China	1	Rongcheng Mashan Ocean
412326798	9649574	Hong Yang 8	China	1	Rongcheng Shandong Ocean
412270059	8652732	Jinsheng8	China	1	China National Fisheries Corp
412270001	9146675	Jin Sheng No.3	China	1	China National Fisheries Corp
431644000	9100425	Hakuyomaru No.58	Japan	1	Hakuyo Gyogyo KK

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431602040	9053490	Fukuei Maru No.8	Japan	1	Maegata Suisan YK
431100990	8809218	Chokyu Maru No.68	Japan	1	Chokyu YK
441680000	8703464	No.5 Kyung Yang	South Korea	1	Kyung Yang Fisheries Co Ltd
441431000	8821369	No 735 Oryong	South Korea	1	Sajo Industries Co Ltd
441038000	8709054	306 Daehwa	South Korea	1	Dae Hae Fisheries Co Ltd
441014000	8811120	No.302 Daehwa	South Korea	1	Dae Hae Fisheries Co Ltd
440952000	8821498	No.620 Dong Won	South Korea	1	Dong Won Fisheries Co Ltd
440920000	8920919	731oryong	South Korea	1	Sajo Industries Co Ltd
440886000	9041100	725 Oryong 0	South Korea	1	Sajo Industries Co Ltd
440656000	8703878	305 Oryong	South Korea	1	Sajo Industries Co Ltd
440641000	8905579	No.622 Dongwon	South Korea	1	Dong Won Fisheries Co Ltd
440517000	8916372	Panalox 503	South Korea	1	Silla Co Ltd
416679000	8674962	Da Sheng	Taiwan	1	Shye Dah Fishery Co Ltd
416353000	8648640	Lung Soon No.886	Taiwan	1	Slong Soon Fishery Co Ltd
416338000	8629242	Yang Shun No6	Taiwan	1	Yang Shun Fishery Co Ltd
416303000	8648638		Taiwan	1	Shang Shun Fishery Co Ltd
416249600	9783021	Hung Shing No.112	Taiwan	1	Xin Xiang Fishery Co Ltd
416247500	8795443	De Chan No.26	Taiwan	1	Kuo M-Z
416237800	8777908	Yu Shun No.668	Taiwan	1	Fang C-W
416237700	8784016	Yu Shun No.66	Taiwan	1	Yang C-H
416235500	8661783	Jin Hong Cheng	Taiwan	1	Rptd Sold Undisclosed Interest
416233700	8748749	Maan Yih Feng No.366	Taiwan	1	Maan Yih Feng Fishery Co Ltd
416232600	8748799	Chang Yi No.868	Taiwan	1	Hong C-Y
416229700	8535128	Feng Yu Qun	Taiwan	1	Huang C-F
416229500	8530219	Hai Chien Hsing No16	Taiwan	1	Hu S-H
416226600	8341204	Jing Man No.168	Taiwan	1	Hung S-F
416221800	8794748	Jin Hsiang Man	Taiwan	1	Li T-J
416221500	8540989	Xing Fu Fa	Taiwan	1	Chen Hung C-P
416217900	8540185	Chang Yi No38	Taiwan	1	Hung K-C
416198800	8341216	You Fu	Taiwan	1	Hung K-H
416198700	8530271	Chin Chi Hsing No.2	Taiwan	1	Lay W-N
416174600	8961494	Hsieh Ta	Taiwan	1	Hong Yuan Fishery Co Ltd
416164600	8648614	Lung Soon No116	Taiwan	1	Hong Yen Fishery Co Ltd
416154700	8549583	Hsin Ming Tsai No6	Taiwan	1	Tsai H-L
416103500	8669448	Ray Home	Taiwan	1	Tien LC
416082900	8541581	Chao Yi No188	Taiwan	1	Lee I-T
416075700	8540707	Shun De Sheng No 3	Taiwan	1	Tsai WL
416052600	8664838	Essien	Taiwan	1	Shun He Fishery Co Ltd
416008922	9972282	Yi Rong No.268	Taiwan	1	Yi Shun Fishery Co Ltd
416008422	9961257	Chuan Fa Shian 288	Taiwan	1	Chen Tian L-J
416005647	9869021	Cyuan Shun No.686	Taiwan	1	Cyuan Shun Fishery Co Ltd
416005097	9807621	Chi Win No1688	Taiwan	1	Chen Ching Ju

MMSI	IMO	Name	Flag	TS	Registered owner
416004687	8782549	Jin Chang No.21	Taiwan	1	Hsieh C-C
416004675	8782496	Jin Chang No.10	Taiwan	1	Chen Y-L
416004594	8564715	Chien Yuan Ming	Taiwan	1	Hung J-H
416004591	8667311	Chi Hong No899	Taiwan	1	Lin T-H
416004583	8778419	Fu Yu No.8	Taiwan	1	Lee W-Y
416004372	8786181	Jin Fu Shun	Taiwan	1	Chen Y-H
416004341	8534904	Chuan Shyang No22	Taiwan	1	Tsai Huang M-K
416004299	8778380	Yi Man No.3	Taiwan	1	Jeng Jean T-D
416004242	8795352	Nian Sheng168	Taiwan	1	Wu Y-L
416003793	8547212	Man Ying Cai No.6	Taiwan	1	Chen L & Li L
416003703	8524129	Maan Yu Feng 368	Taiwan	1	Tsai M-S
416003600	8652770	Huang Fu	Taiwan	1	Tsai C-T
416003556	8526103	Sheng Long Yu No.268	Taiwan	1	Yang Y-R
416003484	8786997	Jin Sing Shyang No11	Taiwan	1	Hung F-C
416003315	8542808	Shun Yi Sin	Taiwan	1	Tsai C-F
416002981	8555142	Ji Fu No68	Taiwan	1	Lin F-T
416002804	8542793	Syu Man Cai	Taiwan	1	Tsay J-W
416002695	8785670	Lien Chi Fa No.98	Taiwan	1	Lin J-S
416002569	8792685	Shin Jyi Wang No.6	Taiwan	1	Kang MJ
416002568	8539837	Feng Cheng Long	Taiwan	1	Xu DJ
416002556	8540599	Sheng I Tsai No168	Taiwan	1	Cheng C-Y
416002477	8795390	Shun De Sheng No 16	Taiwan	1	Lin L-C
416002232	8787276	Ming Tsair Fa No60	Taiwan	1	Tseng S-F
416002154	8535635	Dar Long Cheng No.2	Taiwan	1	Hwang L-T
416002051	8526098	Chyuan Liang Fa 36	Taiwan	1	Jhang W-S
416001567	8535491	Jin Chuan Yi	Taiwan	1	Lin C-C
416001245	8540719	Sheng I Tsai No.668	Taiwan	1	Chen H-J
416000247	8540197	Sheng Yi Cai No113	Taiwan	1	Huang C-P
416000246	8540678	Sheng I Tsai No.313	Taiwan	1	Chen H-J
416000137	8552047	Jenn Feng Yi No1	Taiwan	1	Huang Q-Y
577388000	9011442	Bison	Vanuatu	1	Western Union Fishery Co Ltd
577309000	8504521	Lockyoean.No.168	Vanuatu	1	Full Ocean Fishery Co Ltd
577289000	7815337	Yi Shun No.101	Vanuatu	1	Yi Fa Fishery Co Ltd
577254000	9119957	Huang De	Vanuatu	1	Han Hsin Fishery Co Ltd
577251000	8670710	Kouryo	Vanuatu	1	Koueki Corp
577246000	8717037	Ocean Star 8	Vanuatu	1	Ocean Harvest Fishery
577021000	9020883	Kai Shin	Vanuatu	1	Kai Shin Fishery Co Ltd
576975000	8996152	Yong An	Vanuatu	1	Yong Fu Fishery Co Ltd
576843000	9254991	More Rich	Vanuatu	1	Sun Rise Fishery
576770000	8996114	Longpsyc	Vanuatu	1	Long Bow Fishery Co Ltd
576726000	8996140	Zheng Yu	Vanuatu	1	Qi Xiang Fishery Co Ltd
576690000	9260249	Chim Chun No.12	Vanuatu	1	Sheng Sheng Fishery

MMSI	IMO	Name	Flag	TS	Registered owner
576682000	9260237	Da Yu No.2	Vanuatu	1	Ever Fortune Fishery
576649000	8996138	Da Wang	Vanuatu	1	Yong Feng Fishery Co Ltd

10 Appendix B: List of carrier vessels involved in transhipments

Carrier vessels involved in transhipments in our dataset. The vessels are shown in descending order of the number of transhipment events (TS). Full details are provided in Attachment *WCPFC_hs_carrier_vessels.csv*.

MMSI	IMO	Name	Flag state	TS	Registered owner
356203000	9459591	Taiho Maru	Panama	145	Princess Line SA
372768000	8604967	Full Kuo Shin	Panama	117	Full Kuo Corp
440237000	9194919	Oceanus	South Korea	91	Dongwon Industries Co Ltd
440283000	9172909	Seiyu	South Korea	91	Green World Co Ltd
416064900	8676300	Dong Horng No.899	Taiwan	91	Lin C-Y
416730000	7234210	Lian Jyi Hsing	Taiwan	89	Lian Jyi Hsing Marine Products
441032000	8808161	Seishin	South Korea	65	Green World Co Ltd
412421074	9839363	Pingtairongleng2	China	62	Pingtairong Ocean Fishery
412421073	9834894	Pingtairongleng1	China	40	Pingtairong Ocean Fishery
374048000	9220653	Shin Ho Chun No.101	Panama	26	Tunago Shipping Co Ltd
441418000	9684067	Seibu	South Korea	26	Green World Co Ltd
373417000	9133317	Hanaro	Panama	25	Sealand Trading Service Corp
440217000	9163439	M/V Badaro	South Korea	25	Dongwon Industries Co Ltd
413312990	9946283	Heng Hong 5	China	24	Zhejiang Henghong Shipping
416702000	7920869	Sheng Hong	Taiwan	19	Sheng Hong Fishery Co Ltd
352894000	9278612	Mylo	Panama	18	Sealand Trading Service Corp
416602000	7323401	Shun Tian Fa No168	Taiwan	18	Hon Shun Fishery Co Ltd
412421071	8524442	Pingtairongleng6	China	16	Zhoushan Rongyourong Ocean
441407000	9172442	Lake Dream	South Korea	8	Ji Sung Shipping Co Ltd
373381000	9105293	Futagami	Panama	7	Hongkong LHF Pelagic Co Ltd
372047000	9071583	Meita Maru	Panama	6	Panama TRL SA
374140000	9262182	Shin Ho Chun No.102	Panama	4	Tunago Shipping Co Ltd
356889000	9136890	Angara	Panama	3	Angara Shipping Ltd
374888000	9620384	Genta Maru	Panama	3	Panama TRL SA
576728000	9048603	Lung Yuin	Vanuatu	3	Chang Soon Shipping Corp
355739000	9819923	Harima	Panama	1	Wang Tat Corp Pte Ltd
441258000	9194892	Lake Aurora Ai	South Korea	1	Ji Sung Shipping Co Ltd

11 Appendix C: Carrier vessels and transhipment logistics

11.1 Carriers operating arrangements

Carrier vessels operate under several arrangements, including a charter model, an integrated model or a service provider model.[19] Ownership and operational control arrangements of carrier vessels involved with in tuna transhipment are dynamic and varied, but can broadly be categorised into three main types:

- Charterer model: Under this model, a chartering company leases a carrier vessel, owned and crewed by an independent owner. The chartering model is the one favoured by each of the three main purse seine tuna traders in the WCPO and is the most common operational model. Two basic modes of charter are available.
    - a time charter, under which the charterer leases the carrier for a defined period (e.g., one year); and
    - a voyage/space (or 'spot') charter, under which the charterer 'buys' space on a carrier vessel for one voyage at a time.
- Integrated fishing-carrier companies: Several fishing companies own and operate their carrier vessels as part of an integrated supply chain. These companies tend to be larger, with a sufficient critical mass of catching vessels to justify owning and operating their carrier vessel(s). Many companies also have financial interests in post-harvest processing facilities and use carrier vessels as a component of their integrated supply chain. Integrated fishing-carrier vessel companies have commissioned many of the newer carrier vessels commissioned in the past decade.
- Logistics service provider: These companies tend to have no interest in fish-catching vessels. They have entered the tuna transhipment business from the 'shipping end', not the 'fishing end'. Their primary interest is in providing a commercial service to transport fish from the fishing grounds to processing facilities or directly to market.

Each operating model can result in different flag States being responsible for the vessel's operation. Under some operating models, the actual responsible parties for the vessel can be less clear, which can impact the risk and likelihood that the carrier vessels may engage in IUU fishing activities.

11.1.1 Where do they meet / Rendezvous Points?

Most high seas transhipments in the WCPO occur outside the Pacific coastal countries' exclusive economic zones (EEZs). The fleet managers of the longliners pre-arrange rendezvous points with the carriers' managers, and meetings take place in these pre-arranged locations based on where most of the longliners are at expected times, and the carrier's schedule also depends on the weather.

Some hotspots seem based on the dynamics of fleet operation in the EEZ of FFA members that choose to tranship in the HS rather than impracticably.

The example below illustrates this:

[19] MRAG, 2019. *WCPO Transhipment Business Ecosystem Study*

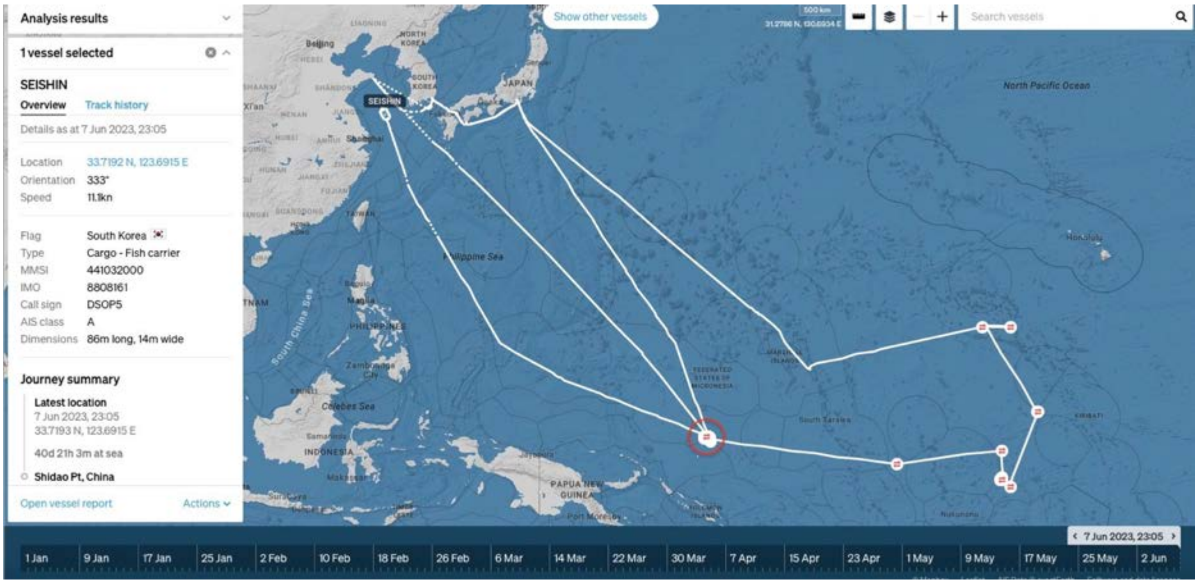


Figure 25: Overall consecutive Trips of the Seishin

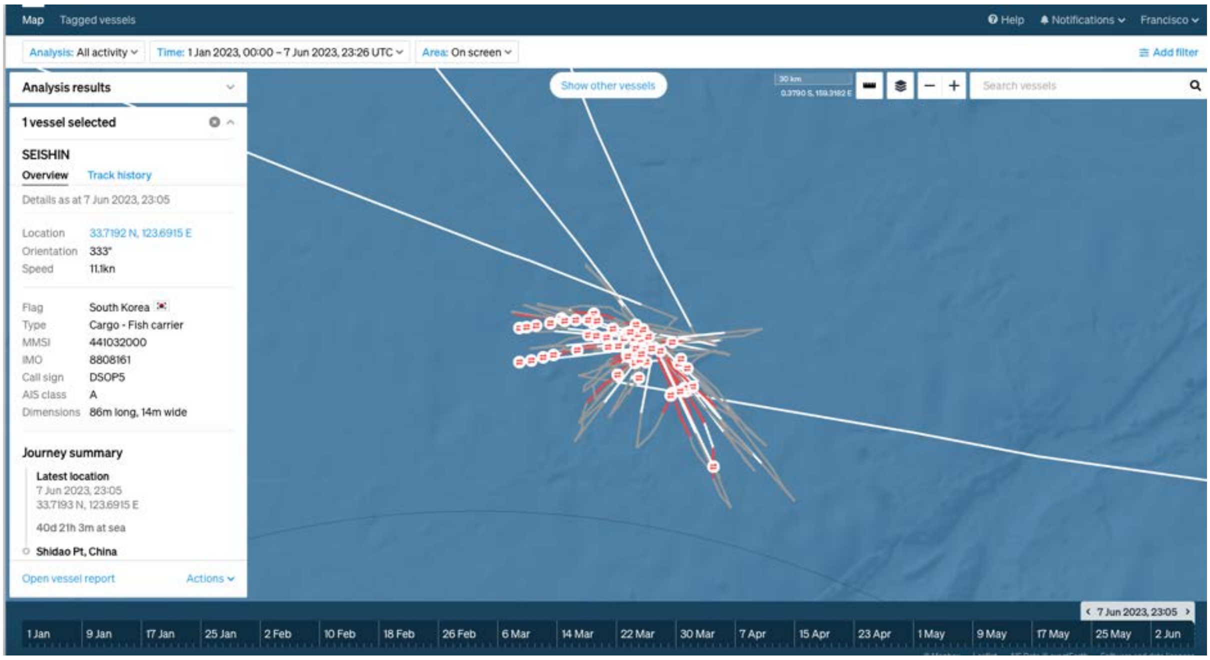
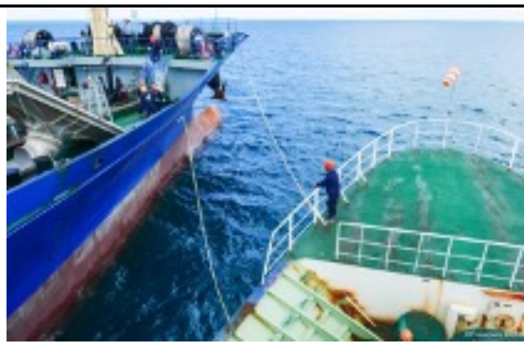


Figure 26: Main area of transhipment by the Seishin over consecutive trips

11.2 Transhipment operational logistics

11.2.1 <u>Manoeuvres in a High Seas Transhipment</u>

Once the fishing vessel comes close to the carrier, generally the following steps take place:

Alongside (ropes tied) The fishing vessel comes alongside the carrier vessel. The carrier lowers large (Yokoyama) fenders are lowered from the carrier vessel before FV comes towards the carrier vessel, generally from the rewards side, now most carrier masters (and depending on the design) secure arriving vessels of the port side of the carrier, but sometimes it may be on starboard,	

but as said in most cases leeward side. Ropes are secured at the bow first and then at the stern (if there is a problem, the carrier master faces a bit of the wind, and the stern will come alongside by itself).

Depending on the weather and the size difference in between the freeboards of both vessels, this manoeuvre can take up to 30 minutes. Note from here is when things start to vary, the more we move towards transhipment, the more deck arrangements, cranes set up and manning, hatches openings, nets in between the vessels, pallets, chutes, etc need to be made, and the longer it takes.

It is important to understand the operational range of a carrier crane (*is always the carrier crane doing the transfers*) needs t align with the very reduced open area of the Longliner, they can't load and unload from any part… it is most of the time an arad of 6 to mt long and 4 to 6 wide only.

Again, depending on the weather, this can take another 30-40 minutes to set up everything (cranes, nets in between the vessels, pallets, chutes, etc. Hence in best-case scenarios, it may take 40 to 60 minutes from the time both vessels get in rope throwing distance from each other

Generally, fishing vessels are secured to the port side of the carrier vessel, but in many instances, there may be 2 and up to 3 in large carriers vessels alongside on port and starboard. Depending on weather this process can take up to 30 minutes.

Transhipment (Transfer of fish).

Things move in between vessels in cargo nets and/or "strings" in the case of LL. In LL most frozen fish fish has a closed loop of monofilament drilled through their carcass (generally at the caudal end) to help with their movements and transfer, most likely added when the fish were hauled onboard the longliner. When moving the fish in "strings" a closed circle of thick rope is passed through the monofilament loops to cluster the fish together. Then ends of the looped rope go in the hook at the end of the carrier's winch/boom cable, and that way, they pass over

Most transhipping longliners (Asian fleet) longliners have a very similar deck configuration, so it is not possible to do two things at once (*receiving goods and sending over fish*). They have small hatches, one or two on deck, one more central, and two equally sized hatches towards the stern and bow end of the deck, and these may be horizontal ones on dry lockers.

Fish is tied up to the hook of the carrier winch and passed over to the carrier either in strings or cargo nets.

The bottleneck for speed is how much fish cons come at once through the hatches (*as can be seen in the picture above on the left*), and not the size of the nets.

While the fish is being transferred, the crew manually or using a small winch/pulleys system moves the fish from holds and lockers to the deck to then get into nets and or stings… this is the process that defines the speed of transhipment.

Also, there is the loading strategy of the master... initially, you want to keep species separated to facilitate transhipping, but you also need to consider the boat stability and fishing rates per species of the trip before; sometimes is all YF and so on.

Some of the rates of ALB TS are faster than other species, this is because it tends to be a much more target-specific fishery. Therefore, you have much albacore being stored next to each other, which makes the process easier. Vessels targeting albacore in the South are quite more homogenous in the catch rates over the tropical ones.

Then, when vessels get alongside, you may only have a contract to unload Albacore, for example, and have to crawl to the guts of the freezer and sort them out, 1 by 1, other times, you retain YF and BET and send by-catch away, again 1 by 1.

Furthermore, you may be receiving supplies and bait as well, and that needs to go where fish is not coming out, so it gets quite logistic sometimes.

Transhipments are sometimes interrupted by other activities, mostly the movement of cargo and infrequently the movement of catch between hatches. Transhipment is also interrupted by rain and crew rest.

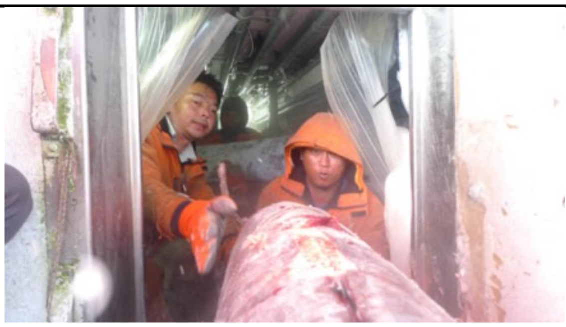
Is important to remember that to have safe operations the carrier vessel will be facing the wind at a speed similar to that of the wind so as to stay in a stable position. This means that the carrier main engine will be on.

Transhipment rates

This depends on many factors, but fundamentally how much fish is transferred and what method is used (nets or strings). A reasonable estimate is around 10 tons an hr for nets in LL and around 7-8 for strings. This is measured from the time of the first transfer until the last.

Any time calculation must include stoppages for rain, weather, rest and movement of fish between hatches and cargo transfer occasionally. Deidre Brogan (2020) reports total transhipment times in between 10 and 53 hours. But none below 10 hrs seems feasible.

It can be possible that they may get together for a while to do some transhipment and or goods transfer, and then separate because of weather or to re-arrange loads and then get back alongside , so times can be added over events, yet the time to get alongside will have to be accounted every time.



Loading of fish in the carrier

Once on board, the fish pass below deck to be loaded into hold that will take most of the hull over various decks. Freezing such large amounts of fish requires very large powerful freezing equipment and high volume holds which occupy much of the vessel. Many carriers separate the loads of the different donor fishing vessels with old nets, the carrier’s cargo plans keep a record of where is what on board.

Transfer of Cargo and Crew

Cargo transfers from carriers to fishing vessels are part of the transhipment process. Cargo is mostly contained inside large wooden boxes and can contain various items like bait, clothes, food and machine parts.

Crew-wise, it depends of prearrangements in between the vessels. is cheaper and less complex from visa perspectives for some nationalities to do crew changes via carriers than through flights via countries with complex visa requirements

Weather/ Sea conditions

Having two vessels alongside, mainly when there is a big size difference between them, is an intrinsically risky situation.

Once vessels are alongside, even small changes in sea conditions can change the heaving, swaying and surging of the smaller vessel, which may lead to the separation of vessels until conditions get better.

Offside (ropes untied) The fishing vessel steams away from the carrier vessel. The fishing vessel threw off its ropes very soon after transhipment (or cargo transfer) is complete. Fenders stay in place until the carrier is ready to steam to the next destination.	

11.2.2 <u>When is it worth doing a Transhipment?</u>

One issue that is only sometimes part of the discussion is: what will be gained from a TS?

It is all about economics at sea, and volumes are well accounted. Hence, as an LL captain, will you get with another vessel to transfer 10 mt? What is the economic advantage of that?

You would have spent more fuel to get to the rendezvous point than the advantage gained for the TS.

Of course, high-value fish, like bluefin tuna, will skew the reasons. One could pass a few tons of ULT Bluefin Tuna (-35 to -60C) to a carrier with the capacity to maintain such temperatures (not many around). Nevertheless, the whole logistics of the manoeuvring and travel time still apply.

11.3 Other benefits arising from port transhipments of longliners

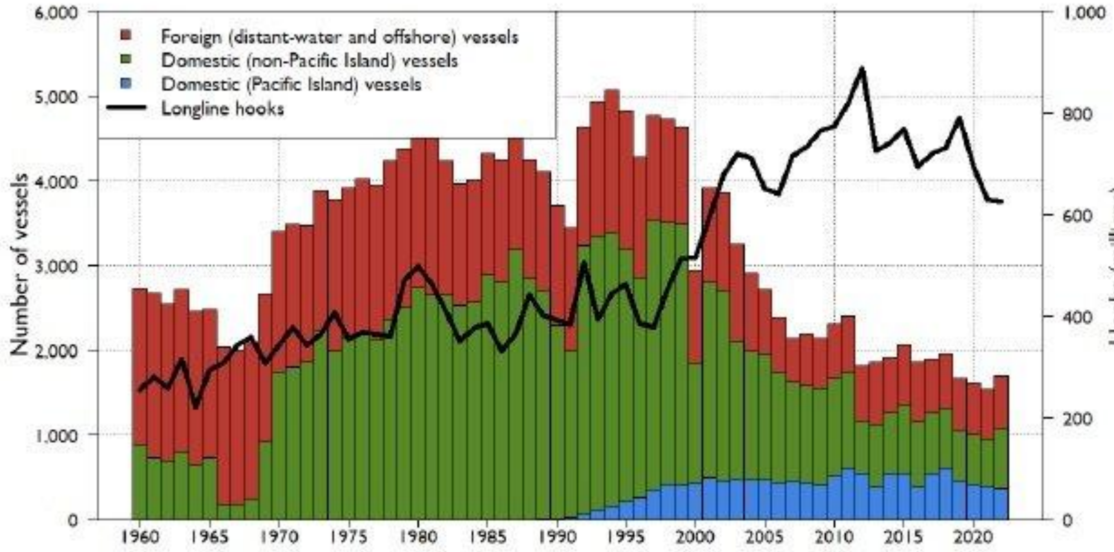
11.3.1 <u>Crew Labour Rights</u>

Due to the infrequent visits of HS large liners to Pacific ports and there is evidence of several vessels remaining at sea for durations exceeding 16 months. Reprovisioning and crew changes occur exclusively during transhipment at sea. There is no balancing in the number of crew members embarking and disembarking. As no immigration status applies to crew on board most DWFN longliners, therefore making it impossible to verify the identity of anyone boarding or disembarking, as well as the time and location of such actions.

Albeit the fishery has been declining in volumes and number of vessels over the years, but a more direct measure of effort (hooks fished) has shown a different trend. Total hooks fished in the WCPFC-CA increased from a level of 400 million in the mid 1970s to 600 million in the early 2000s to 800 million in the early 2010s. The peak year in hooks fished was 2012 at 888 million hooks; the level in 2021 was 612 million hooks, a decline of 12% from the 2020 level, and nearly 16% below the average of the previous five years[20].

The graph below presents the indices of fishing effort, in fleet sizes and number of hooks fished, for the longline fishery in the WCPFC-CA.

[20] WCPFC, 2023 Tuna Fisheries Assessment Report. https://meetings.wcpfc.int/node/21445



The height of LL in the WCPO occurred between 1991 and 1994, with nearly 5000 vessels soaking approximately 400 million hooks. The current total is around 600 million hooks; however, there are only about 1600 vessels, or roughly one-third of the fleet, from 1991 to 1994. How could this be possible? The Fleet has rarely been renewed, and deck and gear setting technology is nearly identical, so the most obvious explanation is that the crew's labour hours has been duplicated.

Bringing the Longline fleet to port will significantly facilitate the assessment of working conditions on board and give the crew the option to voice grievances.

11.3.2 Electronic Monitoring

While some see camera monitoring as a viable alternative to onboard human observers, others feel that onboard observers will remain necessary and complementary for the foreseeable future, at minimum, to perform biological sampling and compliance monitoring where cameras are insufficient. The reality is that EM systems can complement the role of human observers and enhance overall observer coverage, particularly in the longline fishery, which barely struggles to be above 5 %—7.5% coverage.

Although the cost of internet access on board ships is decreasing rapidly, many fleets contend that transmitting live video footage via satellite is currently too expensive. As a result, the footage is stored on a hard drive and sent for analysis when the vessel reaches port (typically every one or two years, which is not the ideal option for compliance). Alternatively, the hard drives containing the footage are passed to carriers at sea, delivering them to a designated analysis location. This introduces additional complexity and potential hazards (for example, an operator may intentionally damage the disc before handing it over to the carrier and then falsely assert that it was in proper operating condition).

The most favourable choice is to arrive at the port for transhipment or unloading. As a licensing requirement, it may be prudent to mandate that vessels without "live transmission EM" capability must come to port with the Hard Drive.

11.3.2.1 MARPOL

In 2021 FFA[21], published a study on plastics in longliners and purse seiners in the WCPO. It identified and assessed volumes produced on board and then potentially dumped, it suggested

[21] FFA (2021) An assessment of fishing vessels plastic waste generation in the WCPO region and potential measures to improve waste management in the fleet. https://www.ffa.int/download/fishing-vessels-plastic-waste-generation/

practical and policy-based alternatives aligned to the regional framework (WCPFC CMM 2017-04) [22] and the international one (MARPOL Convention)[23] under limited enforcement opportunities.

The study estimated that between 241 and 560 tonnes of plastic waste from bait alone is being dumped at sea yearly, while the figure for cardboard is between 334 and 776 tonnes.

Either waste is dumped into the sea or returned to port at some point and in some form. MARPOL does not allow the dumping of any solid wastes considered in this study into the ocean, including incinerator ashes. Thus, all vessels should return with some quantity of waste to be off-loaded at the port.

Yet, if HS Longliners do not come to port and don't tranship waste (it is not in any receipts or declarations), the only safe assumption is that it is dumped at sea.

The issue of onboard waste management is fundamentally a logistical challenge; all materials that become waste were put on the ship either in port or during a carrier transhipment; thus, existing reversed logistical pathways must be used.

Pacific Island ports already have a domestic waste crisis and are, in very large part, unsuitable places to take foreign waste generated by overseas business operations. Therefore, aside from local-based fishing vessels, vessel waste must be returned to originating home ports. Carriers in port are much better placed to have better waste management systems because they have more space, can operate small compactors to increase waste density, can operate safe and compliant incinerators, and can handle and stow larger waste containers, thus: Carrier vessels must accept waste from fishing vessels.

There is presently no way to control MARPOL compliance or transhipments at sea (EM has a potential role), yet for the CMM to work, longliners must come to port and tranship their waste to carriers under supervision.

11.3.2.2 Bycatch Reporting

Many Sharks and billfish are at risk or are being overfished in the region. The limited knowledge of these stocks and their poor status directly result from the failure to monitor and manage the high seas longline fisheries properly.

The table below from SPC's latest status of the stocks is self-explanatory.

[22] https://cmm.wcpfc.int/measure/cmm-2017-04

[23] https://www.imo.org/en/KnowledgeCentre/ConferencesMeetings/pages/Marpol.aspx

Stock status summary of key shark species relevant to WCPFC

Stock	Region	Assessment method	Overfished?	Overfishing?	Conservation status IUCN/CITES appendix
Southwest Pacific shortfin mako (2022)	South west WCPO	Integrated assessment	Inconclusive	Inconclusive	Vulnerable / .ii
Southwest Pacific blue shark (2016, **2021/22**)	South west WCPO	Integrated assessment	No	No	Near threatened / .ii
Oceanic whitetip (2012, **2019**)	WCPO	Integrated assessment	Yes	Yes	Critically endangered / .ii
Pacific silky shark (WCPO 2012/13, EPO 2014, **2018**)	Pacific wide and WCPO only	Integrated assessment	WCPO	Yes	Vulnerable / .ii
Pacific bigeye thresher shark (2017)	Pacific wide	Sustainability risk assessment	NA	No clear statement on risk	Vulnerable / .ii
Porbeagle shark (2017)	Southern hemisphere	Sustainability risk assessment	NA	Low risk in southern WCPO	Vulnerable / .ii
Whale shark (2018)	Indo-Pacific	Sustainability risk assessment	NA	Moderate/Low risk from purse seine in WCPO	Endangered / .ii
Hammerhead sharks	Not assessed	Not assessed	Unknown	Unknown	Critically endangered x2 Endangered x 1 Vulnerable x 1 .ii (except winghead)
North Pacific shortfin mako (ISC **2018**)	North Pacific	Integrated assessment	No	No	Near threatened / .ii
North Pacific blue shark (ISC 2017, **2022**)	North Pacific	Integrated assessment	No	No	Near threatened / .ii

As per seabirds, the poor status of some species, like the Southern Royal Albatross (Toroa) is a direct consequence of the high levels of mortality coming from HS longliners.

Bringing them to port would allow under Port State Measures, to assess compliance with the requirements of CMM 2018-03 on tori lines and weighed branch lines, for example, also as ports have access to VMS, and as such, they could evaluate as part of the risk assessment of incoming vessels, if they were setting at night.

12 Appendix D: Comparison of the tuna RFMO high-seas transhipment observer programmes

Details	IATTC	IOTC[24] [25]	ICCAT[26] [27]
Office locations	Florida, USA Alaska, USA	London, UK Cape Town, SA	London, UK Cape Town, SA Madrid, Spain
Coverage	100% for transhipment carrier vessels		
Years' operating	12	13	14
Tenure renewal	Every 3 years	Annual	Annual
Average Deployment length (days)	73	60[28]	57[29]
Number of deployments	42	65	16
# of carrier vessels in the ROP	87	101[30]	175[31]
Actual # of carrier vessels receiving fish (2019)	20	27	13
# of donor LL able to tranship under the ROP	1107 [32]	988 [33]	1070 (ICCAT vessel list)[34]
Actual # of LL vessels transhipped	285	370	150
# of at-sea TS monitored	605	1,317	467
Nationality for Observers eligibility	USA, Taiwan, Panama, Solomon Islands, Fiji, Federated States of Micronesia, Papua New Guinea	Any National from an FAO country	Any National from a member of an ICCAT CPC

[24] Report on establishing a programme for transhipment by Large-Scale Fishing Vessels prepared by IOTC Secretariat. IOTC-2020-CoC17-04a [E]. 31 July 2020. https://www.iotc.org/documents/report- transhipment-resolution-1906-—-secretariat's-report

[25] A summary of the IOTC Regional Observer Programmed during 2019. Annual Contractor's Report (MRAG and CAPFISH). IOTC-2020-CoC17-04b [E]. 20 March 2020. https://www.iotc.org/documents/summary-iotc-regional-observer-programme-during-2019-contractor

[26] A summary of the ICCAT regional observer programme 2019 report - annual contractors report (MRAG and CapFish). https://www.iccat.int/com2019/ENG/PWG_402_ENG.pdf

[27] ICCAT reports are based on transhipment completed from completed between 1 September 2018 and 31 August 2019.

[28] Information provided via comm with MRAG.

[29] Ibid

[30] IOTC Record of currently authorised Vessels as of 2/15/2022 https://www.iotc.org/vessels/current

[31] ICCAT Carrier vessel registry as of 2/15/2022 https://www.iccat.int/en/vesselsrecord.asp

[32] IATTC Vessel database as of 2/15/2022. Regional Vessel Register List (iattc.org)

[33] IOTC Record of currently authorised Vessels as of 2/15/2022 https://www.iotc.org/vessels/current

[34] ICCAT Carrier vessel registry as of 2/15/2022 https://www.iccat.int/en/vesselsrecord.asp

Details	IATTC	IOTC	ICCAT
Observer nationality different for Flag state	Not nationals of the flag state, however, they may be from the same country the vessel is deploying from	Not nationals or citizens of the flag State of the receiving carrier vessel. (To the extent possible)	Not nationals or citizens of the flag State of the receiving carrier vessel
Members participating in ROP ***Also members of the WCPFC in italics***	*China, Chinese Taipei Japan, Korea, Panama, Vanuatu*	*China, Chinese Taipei Japan, Korea*, Kenya, Malaysia, Oman, Seychelles	*China, Chinese Taipei Japan, Korea,* St. Vincent and the Grenadines, Côte d'Ivoire, Namibia, Belize, Senegal
Reporting standards and forms	Standardised carrier observer forms to meet the Commission requirements are provided by MRAG and submitted by observers		
Debriefing	Providers (MRAG Americas) debrief and send finalised data sets to RFMO	Debriefers are Consortium staff Pre-covid - debriefed in London/Cape Town (office) Covid - remote debriefing	
Performance Evaluation/ Auditing	There are no formal audits by the Secretariat, only feedback provided on reports submitted to the Secretariat. Annual reporting outputs by the ROP are reviewed by the Secretariat before reported to the Commission.		
ER / tablet / laptop or manual reporting	Manual reporting through standard forms	All observers are issued with laptops and all communication is done electronically. Data captured in access database Sent via email to MRAG	
Weight and species estimation (Visual/own crane scales/ vessel crane scales)	Observer visually estimates the number of fish by species in each string and multiples by the average weight by species to derive estimates	Visual estimate of numbers of fish & species composition, weights are in most instances, determined from the vessel's declaration and proportioned in accordance with the observers counts. Weight scales are used by some vessels.	
Safety / Communication equipment	MRAG Provides: PLB, Survival Suit, Personal Floating Device (PFD), Signal mirror InReach personal satellite communications device	MRAG Provides: PLB and PFD, InReach two-way satellite communications device, Immersion suit with whistle strobe and signal mirror Helmet	
Observers' pay **per day (USD)**	At sea: $340	At sea: €125/day In transit - €65/day	At sea: €125/day In transit - €65/day

	In transit: $350 Training: $453 [35]		
Annual Program Cost (2019) USD	USD $ 1,043,016	~USD $ 810,000 [36]	USD $ 287,000[37]

Note that 2019 is used as a reference year as it is before COVID-19 impacts may have influenced data.

[35] Note that this is the rate charged to the client. Pay rates to observers are variable based on experience and are not made public. Since 2019, rates have been updated to: USD$380 for days at sea USD $371 for travel days USD $630 for training days

[36] Financial Statement: 2019 prepared by IOTC Secretariat. IOTC-2020-SCAF17-04 [E]. https://www.iotc.org/documents/iotc-financial-statement-2019

[37] 2020 Financial Report. Doc. No. STF-202/2020. https://www.iccat.int/com2020/ENG/STF_202_ENG.pdf