A brief from Pew



Fish in a net are transferred to a carrier vessel, somewhere in the Pacific Ocean, for transport to market. The Pew Charitable Trusts

Most Global At-Sea Transshipment Involves a Small Group of Key Carriers

130 carrier vessels conducted more than 70% of RFMO-related transshipment activities

Overview

Transshipment, the transfer of fish or other marine wildlife between a fishing vessel and a carrier vessel at sea or in port, is an important part of the global commercial fishing industry. By moving fish to large, refrigerated carrier ships, fishing vessels can spend less time traveling to port to offload their catches, which reduces operating costs and extends fishing time. Regional fisheries management organizations (RFMO) and coastal states regulate most at-sea transshipment, but in areas where this regulatory control and monitoring are inadequate, the risk of illicit activities—such as misreporting or nonreporting of catches and trafficking of people, weapons or drugs—increases.

Policymakers and enforcement agencies seeking to improve regulation of at-sea transshipment need to understand the activities and patterns of carrier and fishing vessels and which ships interact most frequently. Previous studies have looked at the geographic scope of transshipment to find "hot spots" where large numbers of transshipment events occur, but they have not examined the global connections between the vessels involved.¹ Such connections have implications for countries, businesses and market stakeholders, who all have an interest in ensuring that high seas management is transparent and that vessels and governments comply with existing rules. With funding from The Pew Charitable Trusts, researchers from City University of New York's John Jay College of Criminal Justice began to fill this data gap by conducting a first-of-its-kind study of the spatial patterns and network structures of carrier and fishing vessels. The researchers used Automatic Identification Systems (AIS) data, which includes a vessel's identity, position and other information, to identify and focus on the key carriers responsible for conducting most RFMO-related transshipment events between 2015 and 2020 and describes their owners and insurers, which fishing vessels they interacted with most at-sea, and the networks of ships that the vessels belonged to.

To discern patterns within the complex global transshipment network, researchers analyzed the activities of carriers registered to seven RFMOs: the Commission for the Conservation of Southern Bluefin Tuna, the Inter-American Tropical Tuna Commission (IATTC), the International Commission for the Conservation of Atlantic Tunas (ICCAT), the Indian Ocean Tuna Commission, the North Pacific Fisheries Commission (NPFC), the South Pacific Regional Fisheries Management Organization (SPRFMO) and the Western and Central Pacific Fisheries Commission (WCPFC). (See Appendix A for more information on the methods used in this research.)

Key findings

Identifying the carrier vessels responsible for most transshipment events provides important insights and opportunities for improving regional coordination and oversight. The key findings of this analysis are:

- 130 key carriers (22% of the total studied) conducted 72% (8,840 of 12,322) of the detected RFMO-related transshipments. (See Appendix B for the full list.)
- Interactions between carriers and fishing vessels flagged to Panama and China, respectively, accounted for the single largest share, 24%, of transshipment events between any two flags.
- Based on the identity, number and frequency of fishing vessels the carriers interacted with, as well as how often different carriers interacted with the same fishing vessels, the key carriers fall into 12 distinct "communities," five of which accounted for 65% of all detected transshipment activities, including four that were largely associated with tuna and tuna-like fisheries and one probably associated with the squid fishery.
- The key carriers' transshipment activities primarily occurred in the Eastern Central Pacific and the northern section of the Southeast Pacific, with notable hot spots found just outside of the exclusive economic zones (EEZs) of multiple countries, particularly in the Western Pacific and along the South American and West African coasts.

Based on these findings, Pew recommends that RFMOs and States should:

- Implement globally recognized best practices to improve transshipment management.
- Adopt data-sharing agreements between RFMOs.
- Increase oversight of the key carrier vessels identified.

This brief offers additional information on the key carriers, their communities and the recommendations to help fisheries managers improve control of transshipment around the globe.

Key carriers

Geographic activity

Spatial analyses of the activities of the key carriers showed concentrations of transshipment occurring across the Eastern Central Pacific and northern part of the Southeast Pacific, as well as within EEZs of the Pacific Islands, along the coasts of Peru, Argentina and South Africa, and just outside of the EEZs along the West African coastline. (See Figure 1.)

Transshipment activities were geographically broad and occurred in overlapping RFMO convention areas. For instance, the data showed encounters within the waters shared by the WCPFC, IATTC and NPFC.

Figure 1

Transshipment Happens Across the Ocean but Certain Areas Host the Majority of Activity

Concentrations of key carrier events, 2015-20



Point densities based on standard deviations

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0 to 0.57 (low)
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> 0.57 to 1.34 (medium)

> 1.34 to 2.12 (high)

> 2.12 (very high)

Source: G.A. Petrossian, B. Barthuly, and M.C. Sosnowski, "Identifying Central Carriers and Detecting Key Communities Within the Global Fish Transshipment Network" (2022), https://doi.org/10.3389/fmars.2022.798893



A fishing boat and a carrier vessel, the Tuna Queen, conduct at-sea transshipment in the Indian Ocean. Jiri Rezac/Greenpeace

Flag trends

The study found that most carrier vessels were flagged to just a few countries: Panama (54% of key carriers); Taiwan, Province of China (10%); China (9%); and Liberia (5%). When looking at relationships between flags, Panamanian-flagged carrier vessels had the largest number, 2,082, of encounters with fishing vessels flagged to China, accounting for 24% of all detected transshipments. (See Figure 2.) Carrier and fishing vessels both flagged to Taiwan had the second-strongest connection at 1,109 encounters, or 13% of all transshipments.

Several countries, including Panama, allow foreign-owned or -controlled vessels to register under their flag through an "open registry." In recent years, several countries have highlighted issues regarding Panama's monitoring and control of its registered vessels. For example, in December 2019 the European Union issued a second formal warning to Panama because of the country's persistent failures to meet its obligations to fight illegal, unreported and unregulated (IUU) fishing. And the United States National Oceanic and Atmospheric Administration recorded several violations by Panamanian-flagged vessels in its 2019 and 2021 biennial reports to Congress.²

Figure 2 Transshipment Often Occurs Between Vessels Flagged to Panama and China



Top 12 flag State pairings involved in transshipment

Source: G.A. Petrossian, B. Barthuly, and M.C. Sosnowski, "Identifying Central Carriers and Detecting Key Communities Within the Global Fish Transshipment Network" (2022), https://doi.org/10.3389/fmars.2022.798893

Although the use of open registries is legal, these vessels need more monitoring and surveillance to ensure that they are not contributing to overfishing or misreporting of catch. This is especially important for vessels engaging in transshipment activity in waters where their flag State is not a member of the managing RFMO and is therefore not required to follow that RFMO's management and reporting requirements.

Insurance companies

The study also explored the key carriers' insurers and found that a relatively limited number of companies insure these vessels. The top three firms were Japan Ship Owners P&I Association, Assuranceforeningen Skuld Norway and UK P&I Club.

Global transshipping networks

The study identified 12 distinct networks or "communities" of key carriers and estimated their relative importance and contribution to the overall global network. Five of those communities, which the research team referred to as A, B, C, D and E, collectively accounted for 65% of all activities, with the top three communities (A, B and C) conducting almost half (49%) of global transshipment. (See Figure 3.) Not surprisingly, given the analysis's focus on RFMOs that oversee tuna and squid fisheries, four of the top five communities were largely associated with tuna and tuna-like fisheries and the fifth was probably associated with squid fisheries.

Community A

The top community included 23 key carriers—mostly flagged to Panama and Liberia—that conducted nearly a quarter (22.7%) of the transshipment events examined. Community A's transshipment activity spanned multiple ocean basins and RFMO management boundaries, with noticeable hot spots in the Western and Eastern Central Pacific regions, Indian Ocean, Southeast Atlantic and the Eastern Central Atlantic, as well as near the EEZs of the West African coast.

Community B

This group of 12 key carriers, flagged to Taiwan and Panama, engaged in the second-highest proportion of transshipment events (14.7%), primarily in the Western Indian Ocean and Western Pacific.

Community C

This group, which accounted for 11.4% of the activities and contained five key carriers, showed low overall geographic spread, with transshipment events concentrated in the southeast Pacific region and just outside the EEZs of French Polynesia and Pitcairn Islands.

Community D

Like Community A, Community D's encounters, which made up 8.2% of activities and involved eight key carriers, were spread across the Western and Eastern Central Pacific regions—mainly the equatorial Pacific. However, unlike the other communities, this group conducted significant activity immediately outside of several EEZs, including those of the Solomon Islands, Nauru, Tuvalu, Kiribati, Tokelau and French Polynesia.

Community E

The 19 key carriers in Community E mainly engaged with Panama-flagged fishing vessels. This community operated in a wide geographic area with hot spots in the Northwest Pacific Ocean and high seas areas close to the EEZs of Russia, Peru and Argentina, which are associated with productive squid fisheries.

Figure 3 **5 Vessel Communities Conduct About Two-Thirds of Transshipments** Geographic spread of activities by community, 2015-20



- Community A (2,073 transshipments)
- ▲ Community B (1,210 transshipments)
- \diamond Community D (681 transshipments)
- Community E (793 transshipments)
- Community C (545 transshipments)

Source: G.A. Petrossian, B. Barthuly, and M.C. Sosnowski, "Identifying Central Carriers and Detecting Key Communities Within the Global Fish Transshipment Network" (2022), https://doi.org/10.3389/fmars.2022.798893



The Chinese-flagged Lu Rong Yuan 609 prepares to fish for squid on the high seas near the Galapagos Islands in July 2019. Associated Press

Recommendations

RFMOs and States should take the following steps to ensure that at-sea transshipment activity is appropriately regulated and supports sustainable global fisheries.

1. Implement globally recognized best practices to improve transshipment management

No single set of standards governs the management and monitoring of transshipment. As a result, practices and requirements vary widely among countries and RFMOs, which because of the global scale of the transshipment network, can lead to significant inconsistencies and gaps in regulations and reporting.

In 2022, however, the United Nations Food and Agriculture Organization adopted a globally recognized set of transshipment guidelines, creating a new benchmark for transparency in the movement of fish internationally.³ All RFMOs should use these guidelines to develop and implement reforms to strengthen the management and monitoring of transshipment in the fisheries they oversee.

2. Adopt data-sharing agreements between RFMOs

A lack of information-sharing agreements between RFMOs with overlapping jurisdictions, particularly WCPFC and IATTC, WCPFC and NPFC, and IATTC and SPRFMO—limits fishery managers' understanding of transshipment activity in dually managed waters and of which rules and procedures individual fishing and carrier vessels are following. This creates opportunities for misreporting of the amount and type of species transshipped and other IUU activities and leaves a critical gap in monitoring of the catch and transfer of marine products in co-managed ocean basins.

RFMOs and nations with overlapping jurisdiction should adopt data-sharing memorandums of understanding to help increase monitoring of transshipment activity in co-managed areas and neighboring waters. Regional implementation of effective port State measures can also provide a basis for information-sharing and collaboration, help improve interagency cooperation, and strengthen institutional frameworks.

3. Increase oversight of key carrier vessels

Not only can increased information about key carriers and geographic trends inform the allocation of monitoring resources when capacity is limited, but it also can help fisheries managers implement effective policies based on species of interest or high value. For instance, armed with the knowledge that Community E key carriers operated in high seas areas associated with productive squid fisheries, managers could focus enhanced efforts on those vessels to increase oversight of these often poorly regulated fisheries.

RFMOs, countries, supply chain companies and insurers should focus their monitoring and enforcement efforts on the key carriers identified in this analysis. In addition, RFMOs should determine which of these carriers operate in their convention areas and routinely audit those vessels' reported information, and countries should regularly inspect the fishing vessels that transship with these carriers.



A purse seine vessel transfers tuna catch near Pohnpei, Federated States of Micronesia. The Pew Charitable Trusts



Two fishing boats are seen at sea during sunset. Plug Pattarin

Conclusion

By identifying the key carriers and the vessel communities of which they are a part, this study sheds light on the global reach of these carriers and the true scale of the transshipment network. These findings, in turn, highlight the need for better coordination among countries, businesses and market stakeholders, especially for oversight of activities on the high seas. To effectively manage increasing transshipment activities, stronger regulatory frameworks are needed oceanwide to ensure that vessels are operating within legal requirements and illegal catch does not reach the marketplace.

Appendix A: Methodology

Data sources

The researchers extracted RFMO-related transshipment, carrier and fishing vessel information for the years 2015 through 2020 from three primary sources: Global Fishing Watch's (GFW) Carrier Vessel Portal, Information Handling Services (IHS) Markit's Maritime Portal and Marine Traffic, all of which use AIS data to identify and track vessel activity.⁴

Fishing and carrier vessel identification

The GFW Carrier Vessel Portal uses a database of carrier vessels that GFW identified using "vessel registry lists, national registries, International Maritime Organization numbers, web and search images, as well as a machine learning algorithm used to estimate vessel class."⁵ More information about the data used in the portal can be found on GFW's website.⁶

The research team used the IHS Portal and Marine Traffic website to gather additional information on vessel names, call signs, flags, ownership and insurers.

Transshipment detection

The Carrier Vessel Portal uses AIS data to identify encounters between carrier and fishing vessels, which indicate transshipment activity. GFW defines encounters as "when two vessels, a carrier and the encountered fishing vessel, are detected on AIS data as within 500 meters for at least two hours and traveling at a median speed <2 knots, while at least 10 km from a coastal anchorage."⁷

Transshipment events between two vessels registered to Russia, which accounted for nearly 50% of all detected activities, were unlikely to involve RFMO-managed species and so were excluded from this analysis.⁸ Further, because not all RFMO-authorized vessels are required to transmit on AIS and because vessels that are required to transmit have the ability to turn off their AIS equipment, the data set may not include all transshipment activities during the study period.

Key carrier classification

Researchers described the complex social transshipment networks through "social network analysis," which is frequently used in disciplines such as economics and sociology. Because of the frequent interactions between fishing and carrier vessels, transshipment is inherently social, making this analytical method useful for understanding these relationships on a global scale. The research team identified the key carriers using three methods:

- Calculating the rate of non-repeat transshipments/total number of transshipments.
- Using Degree and Eigenvector centrality scores, which measure how well-connected the carriers are to others and their overall relative importance in the network.
- Applying the Pareto Principle, which determines the percentage of all transshipment activities carried out by each carrier.

Network relationship and community identification

The research team used modularity analysis to identify the "communities" or networks of key carriers within the network, as well as relationships and importance of each cluster to the other communities, by calculating the distribution and strength of individual carrier-fishing vessel connections based on the number of detected encounters between the various vessels studied.

Appendix B: Key Carriers

Maritime Mobile Service Identity (MMSI) Number	International Maritime Organization (IMO) Number	Name	Flag
273210110	8701040	PAMYAT KIROVA	Russia
273211110	8811675	PAMYAT ILICHA	Russia
273316230	8518895	BALYUZEK	Russia
273356610	8136740	PROLIV LONGA	Russia
273420240	8729183	KOMMUNARY NIKOLAYEVA	Russia
273421240	8723402	ANTON GURIN	Russia
273812710	8610277	VSEVOLOD SIBIRTSEV	Russia
351336000	9227596	WINDRAY REEFER	Panama
351383000	8713562	CHENG HANG	Panama
351478000	8530788	RAFAEL	Panama
351527000	8217104	OCEAN MARINER	Panama
351763000	8214839	SHIN HANG	China
351776000	8130837	MING HANG	Panama
351822000	7927453	TAI FU NO 3	Panama
351960000	8921470	MING HANG 5	Panama
352241000	9314612	TUNA PRINCESS	Panama
352247000	8904070	FONG KUO NO.818	Panama
352351000	9072824	AVUNDA REEFER	Panama
352533000	8122385	VIVA 106	Panama
352894000	9278612	MYLO	Panama
353185000	9145920	KURIKOMA	Panama
353946000	9152181	TAGANROGSKIY ZALIV	Panama
354003000	9189885	SHEN JU	Panama
354062000	8800236	HAI FENG 668	Panama
354424000	9851581	YACHIYO	Panama
354458000	9602837	BAO LUCKY	Panama
354469000	8710209	HAI FENG 658	Panama
354493000	9105358	МАВАН	Panama
354871000	8801814	FRIO OCEANIC	Panama

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Maritime Mobile Service Identity (MMSI) Number	International Maritime Organization (IMO) Number	Name	Flag
355317000	8301723	ORIENTAL CHILAN	Panama
355720000	8813582	GLOBAL MARINER	Panama
355739000	9819923	HARIMA	Panama
355827000	9019121	HAI FENG 728	Panama
356065000	9109263	BAO WIN	Panama
356514000	9035084	HAI FENG 618	Panama
356609000	8908193	FRIO LAS PALMAS	Panama
357172000	9067128	YONG HANG 3	Panama
357433000	9066485	BAO REEFER	Panama
357805000	8521830	SKYFROST	Panama
366744930	8958655	VIXEN	USA
367081420	7050195	TUXEDNI	USA
367124290	8332136	CAPE DENBIGH	USA
367137170	7908213	KATRINA EM	USA
367176240	7308542	SEA ERN	USA
367348240	6921270	RELIANCE	USA
367392530	8855205	LAST FRONTIER	USA
367492890	UNKNOWN	ISLAND TRADER	USA
367724590	7309792	VIKING QUEEN	USA
368633000	8990809	ROGUE	USA
370136000	9019119	VIDA I	Panama
370599000	9666481	IBUKI	Panama
370890000	7908770	FORTUNA REEFER	Panama
371335000	8317356	HAI FENG 628	Panama
371717000	8422711	HAI FENG 698	Panama
371719000	8319031	DAFENG MARINER	Panama
371727000	9133305	RYOMA	Panama
371812000	8807662	FRIO POSEIDON	Panama
372033000	8214645	SHUN HANG	Panama
372107000	8801802	FRIO OLYMPIC	Panama
372768000	8604967	FULL KUO SHIN	Panama
373039000	9016985	HAI FENG 688	Panama
373381000	9105293	FUTAGAMI	Panama
373417000	9133317	HANARO	Panama
373451000	8916748	ZEFYROS REEFER	Panama
374014000	8908739	PONTOS	Panama
374048000	9220653	SHIN HO CHUN NO.101	Panama

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Maritime Mobile Service Identity (MMSI) Number	International Maritime Organization (IMO) Number	Name	Flag
374140000	9262182	SHIN HO CHUN NO.102	Panama
374198000	9135169	HAI FENG 718	Panama
374290000	8224432	MING HANG 8	Panama
374363000	9797656	HSIANG HAO	Panama
374407000	9686273	CEPHEUS OCEAN	Panama
374410000	8609280	YONG XIANG 8	Panama
374445000	8609292	QI HANG	Panama
374446000	9241932	HARU	Panama
374610000	9016961	HAI FENG 678	Panama
374612000	8410586	YONG XIANG 7	Panama
374723000	9161613	YUN RUN 3	Panama
374762000	9453418	LADY TUNA	Panama
412331208	8782654	LU WEI YUAN YU YUN 777	China
412420155	8786040	ZHE PU YUAN LENG 208	China
412420331	8307260	RONG ZHOU	China
412421049	9821134	NING TAI LENG 7	China
412421073	9834894	PING TAI RONG LENG 1	China
412421074	9839363	PING TAI RONG LENG 2	China
412421078	9829435	ZHONG JU LENG 1	China
412421088	9844514	JIN ZHOU	China
412436952	8782862	OU YA LENG 6	China
412549015	9882085	NING TAI LENG 8	China
416001900	7900663	YUAN TAI NO.806	Taiwan
416064900	8676300	DONG HORNG NO.899	Taiwan
416110700	7121956	HO YUAN	Taiwan
416308000	7930175	CHEN YU NO.7	Taiwan
416521000	7302031	YONG MAN SHUN	Taiwan
416542000	8680442	HER WEN NO.1	Taiwan
416567000	7305722	LIANCHUANSHENG NO66	Taiwan
416602000	7323401	SHUN TIAN FA NO.168	Taiwan
416696000	6811932	FU JYI	Taiwan
416702000	7920869	SHENG HONG	Taiwan
416730000	7234210	LIAN JYI HSIANG	Taiwan
416778000	7332713	WIN SHUN SHING	Taiwan
416861000	7323396	JIN HWEI NO 101	Taiwan
431201000	8710728	TAISEI MARU NO. 15	Japan
431678000	9086758	TAISEI MARU NO. 24	Japan

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Maritime Mobile Service Identity (MMSI) Number	International Maritime Organization (IMO) Number	Name	Flag
440046000	7807134	SUNSHINE	Korea
440283000	9172909	SEIYU	Korea
440571000	8909680	SEIHO	Korea
440664000	8815009	SL BOGO	Korea
441032000	8808161	SEI SHIN	Korea
441418000	9684067	SEIBU	Korea
529346000	8604967	FULL KUO SHIN	Panama
529837000	7726706	WEI LI	Liberia
529844000	9044358	HE SHUN	Liberia
563418000	9666508	CHITOZE	Singapore
576285000	9003158	FENG LU	Panama
576728000	9048603	LUNG YUIN	Vanuatu
576732000	9194892	SHOTA MARU	Vanuatu
577106000	9133317	HANARO	Panama
636008972	8911102	TRITON REEFER	Panama
636017108	9666493	CHIKUMA	Panama
636017161	9071583	MEITA MARU	Panama
636017162	9620384	GENTA MARU	Panama
636017275	9140097	VICTORIA A	Panama
636017301	9105293	FUTAGAMI	Panama
636017359	9194892	LAKE AURORA	Korea
636017396	9459591	TAIHO MARU	Panama
636017468	9128764	TENHO MARU	Liberia
636017561	9044358	HE SHUN	Liberia
636017709	7726706	WEI LI	Liberia
636017752	8312655	WEI SHUN	Liberia
636018227	9064229	WEI NING	Liberia

Endnotes

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- 3 Food and Agriculture Organization of the United Nations, "FAO Voluntary Guidelines for Transshipment Adopted," accessed Feb. 17, 2023, https://www.fao.org/iuu-fishing/news-events/detail/en/c/1598976/.
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- 5 Global Fishing Watch, "About Global Fishing Watch Carrier Vessels," accessed Feb. 17, 2023, https://globalfishingwatch.org/carrier-vessel-portal/.
- 6 Global Fishing Watch, "Carrier Vessel Portal Disclaimers," accessed Feb. 17, 2023, https://globalfishingwatch.org/carrier-vessel-portaldisclaimers/.
- 7 Global Fishing Watch, "What Is an Encounter in the Carrier Vessel Portal?," accessed Feb. 17, 2023, https://globalfishingwatch.org/faqs/ what-is-an-encounter-in-the-carrier-vessel-portal/.
- 8 A self-contained system of Russia-to-Russia transshipments operates outside of RFMO regulation and has little or no interaction with global transshipment networks.

For further information, please visit: pewtrusts.org/internationalfisheries

The Pew Charitable Trusts

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