Global Fishing Watch

Fact sheet
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Illegal, Unreported and Unregulated Fishing Risk Insights: A New Framework for Analyzing Vessel Behavior

Harnessing automatic identification system data to advance global transparency through structured risk indicators and network metrics

Overview

Illegal, unreported and unregulated (IUU) fishing describes a broad spectrum of activities that violate national laws, bypass international standards or operate outside established management frameworks. Because these activities are often remote and clandestine, making them more difficult to detect and stop, they pose a severe threat to the health of our ocean and the stability of the global economy.

According to the UN Food and Agriculture Organization (FAO), IUU fishing accounts for an estimated 11 to 26 million tonnes of fish annually — roughly one in every five wild-caught fish sold on the market.[1] This illicit harvest results in global economic losses estimated between $10-$23 billion each year.[2]

Illicit harvest of 11 to 26 million tonnes of fish annually

The ramifications extend far beyond financial loss, impacting:

Environmental stability
IUU fishing undermines the scientific basis for stock assessments. By obscuring data on fish removals, it threatens the long-term resilience of global populations and disrupts entire marine ecosystems.

Human security
INTERPOL and the UN Office on Drugs and Crime have identified clear links between illegal fishing and transnational organized crime, including human trafficking, forced labor, and the smuggling of drugs and weapons.

Food security
For many coastal and developing nations, fish provide a primary source of protein and income. IUU fishing directly deprives these communities of their livelihoods and nutritional safety nets.

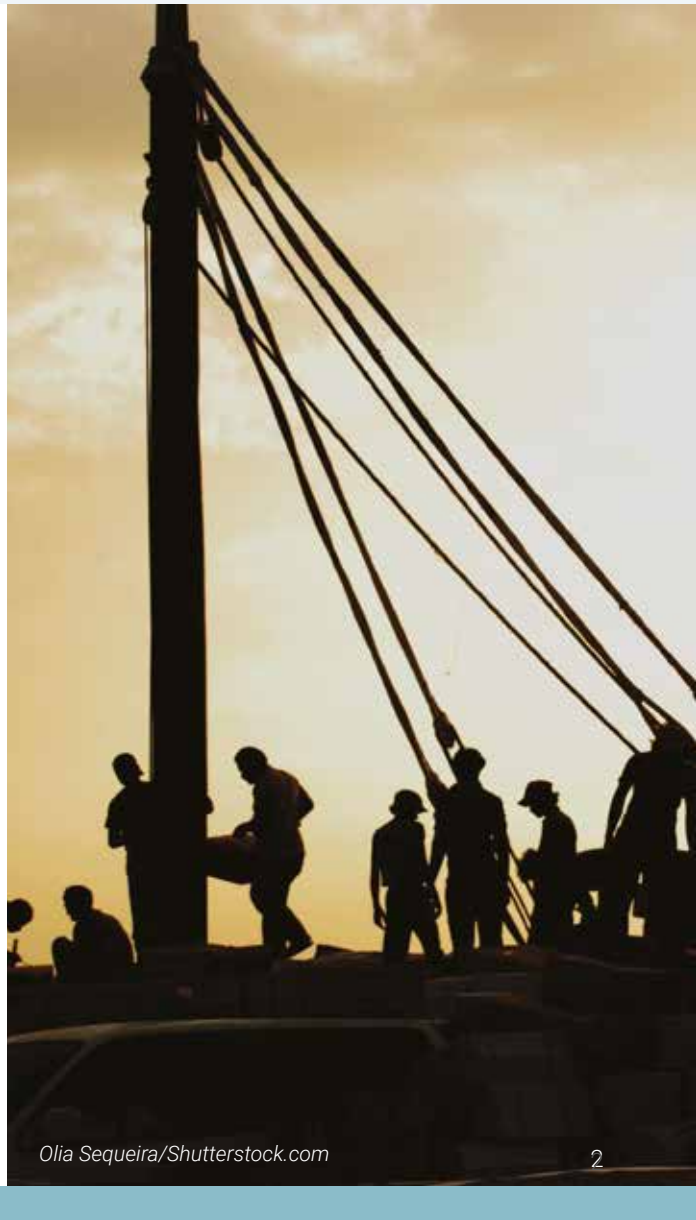
Monitoring these activities is inherently difficult. But monitoring beyond national jurisdictions is particularly challenging due to limited enforcement capacity and the vast size of the high seas. Traditional at-sea and in-port inspections are resource-intensive, and many States lack the physical and judicial capacity to deter these sophisticated networks.

From detection to risk assessment

To track the covert activities of illegal fishing, it is important to look beyond simple locations and instead analyze the "digital fingerprints" left by vessels. While vessel tracking data, such as the automatic identification system (AIS), provides an objective record of activity, identifying a legal violation in real time is complex.

Recognizing these complexities, Global Fishing Watch utilizes a data-driven approach that maps exposure to illicit activity. By identifying behavioral indicators — such as suspicious transmission gaps or proximity to known offenders — the international nonprofit organization provides authorities with the actionable intelligence needed to prioritize inspections and strengthen the implementation of international treaties like the Port State Measures Agreement.[3]

Through the release of a new dataset, IUU Fishing Risk Insights, Global Fishing Watch proposes a data-driven method to assess vessel-level risk.[4] Developed through a literature review and expert consultation, the dataset framework identifies 11 key risk indicators based on who a vessel interacts with, how long it stays hidden at sea, and how transparently it broadcasts its identity during a given year.[5]



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The company they keep

A vessel's social network can serve as a valuable source of information. The IUU Fishing Risk Insights dataset is informed by more than just total at-sea encounters; it specifically monitors whether a vessel is meeting with IUU-listed vessels and those linked to forced labor. By using network metrics, Global Fishing Watch can calculate a vessel's "degree of separation" from bad actors. Even if a vessel has not had direct contact with a vessel reported for forced labor or IUU fishing, a short network distance to these vessels signals a high-risk operational connection.

The social network indicators include:

1. Total at-sea encounters
The frequency of close-proximity events with other vessels, signaling potential transshipment.

2. Encounters with IUU-listed vessels
Interactions with vessels currently blacklisted by regional fisheries management organizations (RFMOs).

3. Encounters with previously IUU-listed vessels
Interactions with vessels previously listed in RFMOs' IUU vessel lists.

4. Encounters with vessels reported for forced labor
Interactions with vessels linked to documented labor abuses.

5. Network proximity to IUU-listed vessels
The degrees of separation between a vessel and known offenders within an encounter network.

6. Network proximity to vessels reported for forced labor
The degrees of separation from vessels associated with labor abuses.

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Persistence and avoidance

Oversight typically happens in port. Therefore, avoiding land is a primary risk signal. The IUU Fishing Risk Insights dataset utilizes the average voyage duration and the number of voyages to identify vessels that may be intentionally staying out of reach of inspectors. Few and long stints at sea often correlate with both illegal catch transfers and the exhaustion or abuse of crews.

The voyage indicators include:

7. Average voyage duration
The average length of time a vessel remains at sea.

8. Number of voyages
The total number of voyages.

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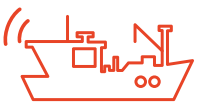
Digital transparency

To ensure the integrity of fisheries monitoring, it is essential to analyze the quality and consistency of vessel tracking data. Global Fishing Watch identifies specific anomalies in AIS transmissions that may indicate attempts to evade oversight.

The vessel tracking indicators include:



9. Suspected AIS disabling
Unexplained tracking gaps indicative of intentional shutdown. This measures total events exceeding 12 hours and 24 hours.[6]

10. Unexplained AIS gaps
Any loss of transmission longer than four hours, regardless of location or reception quality.

11. Suspected identity spoofing
The total time a vessel broadcasts the same identity or maritime mobile service identity (MMSI) number simultaneously with another vessel.

By quantifying these behaviors, Global Fishing Watch provides a standardized framework for assessing data reliability. These signals allow authorities to differentiate between routine technical issues and deliberate efforts to obscure maritime activity.

Because legal frameworks vary by jurisdiction, these indicators serve as signals of relative risk rather than proof of wrongdoing. The dataset is intended to support structured observations of vessels, highlighting those whose observable movements suggest a high risk of illegal activity that warrant further investigation and contextual verification.

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The making of a "good" IUU fishing risk indicator

While the International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing provides a comprehensive framework for maritime activity, these definitions are inherently context-dependent and tied to specific national and regional laws.[7] Because "unreported" and "unregulated" fishing are defined by administrative compliance and missing data — such as failing to submit logs or operating where no framework exists — they cannot be definitively identified through vessel tracking alone.

As such, the Global Fishing Watch risk indicators are designed primarily to assess the "illegal" component of IUU fishing. By tracking "digital fingerprints" — such as unauthorized entry into restricted waters or interactions with blacklisted vessels — the dataset identifies behaviors that signal a potential contravention of national laws or international conservation measures. Consequently, direct detection of the full IUU spectrum via satellite data is not possible, and Global Fishing Watch focuses specifically on assessing risk rather than issuing final determinations of wrongdoing. Legal frameworks are contingent on their jurisdictions; what is illegal in one may be permitted in another.

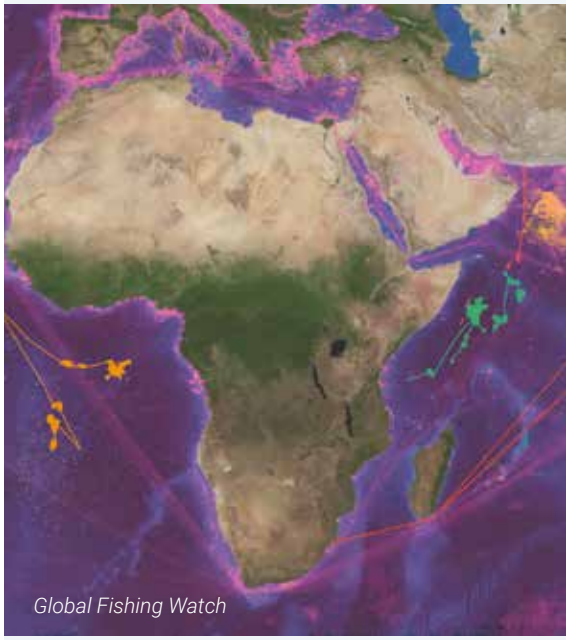
IUU fishing risk indicators can serve as a prioritization tool for authorities, translating behavioral patterns identified by Global Fishing Watch into quantifiable markers of potential noncompliance. The risk indicators on their own do not confirm that IUU fishing has occurred. Rather, they highlight behaviors that have been linked to a heightened IUU fishing risk that may signal that a vessel warrants further scrutiny or investigation.

To be included in our list, an IUU fishing risk indicator must meet the following criteria:

- It must represent a vessel behavior or pattern that has been linked to an elevated risk of IUU fishing.
- It must be computable using Global Fishing Watch data.
- It must be scalable across all vessels broadcasting AIS.

The indicators within this dataset represent observable behaviors correlated with an increased of IUU fishing. These metrics are synthesized from three primary sources: AIS broadcast data, official RFMO IUU-vessel lists and internally maintained records of reported forced labor cases cross-referenced with AIS identities. To ensure robust tracking and accountability, each vessel record includes standardized identity fields, including MMSI, International Maritime Organization number, call sign, flag State and vessel name, verified against both AIS transmissions and official registry data.

Tracking "digital fingerprints" helps identify potential issues



Global Fishing Watch

Each vessel is verified against AIS transmissions and official registry data

Use and limitations of risk identification

Risk identification offers a structured, data-driven framework for prioritizing vessel inspections, providing a critical solution for maritime authorities operating with limited resources. By analyzing behaviors observable through AIS, authorities can assess the likelihood that a vessel has engaged in IUU fishing. This strategic approach allows enforcement agencies to move beyond random sampling, instead focusing their inspection and oversight efforts on vessels exhibiting the highest-risk activity patterns.

However, while AIS is a powerful tool for transparency, it is not without technical and operational limitations.[8] Tracking data can be intermittent due to poor satellite reception in remote corridors, and in some cases, the data may be intentionally manipulated or disabled to obscure a vessel's path. Furthermore, AIS data provides a record of activity but cannot independently capture a vessel operator's intent or provide the complete legal context of an operation.

To address these challenges, IUU fishing risk indicators are most effective when applied in combination as part of a comprehensive vessel or fleet profile. Because a single indicator may reflect a legitimate operational necessity — such as disabling a signal for safety in high-risk piracy zones — one signal alone rarely confirms illicit activity. Instead, the convergence of multiple indicators, such as a suspicious transmission gap followed by an encounter with an IUU-listed vessel, signals a heightened cause for concern.

Ultimately, risk identification serves as a support tool for decision-making rather than a replacement for legal due process. These indicators identify potential noncompliance and suggest where further investigation is warranted; they do not constitute a final determination of wrongdoing. By integrating Global Fishing Watch data with supplemental sources — such as flag State regulations, vessel authorization lists and regional registries — authorities can build a robust evidentiary base to support the sustainable management of global fisheries.

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Strengthening Port Controls With IUU Fishing Risk Insights

The Port State Measures Agreement (PSMA) empowers authorities to safeguard their waters by denying entry or essential services to vessels linked to IUU fishing.[9] This proactive approach relies on mandatory notification that vessel operators must provide before their arrival. During this window, authorities conduct risk assessments to determine if there are reasonable grounds for concern. But since inspection capacity is often stretched thin, port States face the persistent challenge of determining which vessels require the most scrutiny. This is where the integration of IUU fishing risk indicators becomes a critical tool for modern enforcement. By identifying suspicious behavioral patterns before a vessel even reaches port, authorities can transform raw data into actionable intelligence and ensure that limited resources are directed at the highest-risk targets. By shifting inspections to a more structured, data-driven approach, port States can significantly enhance the efficiency and impact of the PSMA.

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Data as a catalyst for accountability

Illegal, unreported and unregulated fishing remains one of the greatest obstacles to the sustainable management of global marine resources. By obscuring the true scale of global catch, these illicit activities undermine scientific stock assessments and threaten the long-term viability of the blue economy. However, the evolution of vessel tracking technology offers a new pathway toward accountability.

Through a synthesis of academic research and expert consultation, Global Fishing Watch has established a framework of experimental risk indicators derived from AIS data. These "digital fingerprints" provide an objective record of maritime activity, offering critical insights into behaviors that — when viewed in aggregate — signal a heightened risk of noncompliance.

It is essential to recognize that these indicators are not a final determination of guilt. They are inherently context-dependent; factors such as vessel type, regional regulatory frameworks and legitimate operational safety requirements must all be considered during analysis. Rather than serving as definitive evidence of wrongdoing, these metrics are designed as a powerful decision-making support tool.

By adopting a structured approach to risk identification, authorities can cut through the vast complexity of vessel behavior. This data-driven strategy enables the strategic prioritization of inspections and enforcement, ensuring that limited resources are directed where they are needed most. Ultimately, the integration of these risk indicators into global oversight mechanisms is a vital step toward a transparent, legal and sustainable future for the world's ocean.

Endnotes

1. https://www.fao.org/port-state-measures/resources/detail/en/c/1111616/.
2. https://www.un.org/en/observances/end-illegal-fishing-day.
3. https://www.fao.org/port-state-measures/resources/detail/en/c/1111616/.
4, https://globalfishingwatch.org/platform-update/iuu-fishing-risk-insights-dataset-release/.
5. https://globalfishingwatch.org/illegal-unreported-and-unregulated-fishing-indicators.
6. See the definition of disabling event in Welch, Heather, Tyler Clavelle, Timothy D. White, et al. "Hot Spots of Unseen Fishing Vessels." Science Advances 8, no. 44 (2022): eabq2109. https://doi.org/10.1126/sciadv.abq2109.
7. https://openknowledge.fao.org/items/dda4ea4e-5603-4984-b22b-ae6cacbf2d1c.
8. https://globalfishingwatch.org/data-documentation/considerations-when-using-automatic-identification-system-ais-data/.
9. https://stopillegalfishing.com/resources/how-to-stop-illegal-fishing/how-to-stop-illegal-fishing-denial-of-port-entry-and-use.

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Global Fishing Watch is an international nonprofit organization dedicated to advancing ocean governance through increased transparency of human activity at sea. By creating and publicly sharing map visualizations, data and analysis tools, we aim to enable scientific research and transform the way our ocean is managed. We believe human activity at sea should be public knowledge in order to safeguard the global ocean for the common good of all.

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