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# Study Measures Countries' Exposure to Illegal Catch, Actions to Keep It From Markets

Results show where implementing the Port State Measures Agreement would have biggest impact

## Overview

Port State measures are a critical part of the potential solution to illegal, unreported and unregulated (IUU) fishing, one of the biggest threats to ocean health. This illicit practice places pressure on the sustainability of the world's fisheries and harms the economies of coastal nations that depend on healthy fish populations.

The United Nations Food and Agriculture Organization's Port State Measures Agreement (PSMA), in force since 2016, requires parties to strengthen their controls on foreign-flagged vessels that seek to use their ports to land or transship fish to prevent illicit catch from reaching national and international markets.

Initiatives by the international community to help States implement the treaty have been hampered by limited outside knowledge about how States manage their ports, how vulnerable ports are to the risk of IUU products flowing through them, and how much progress States have made at combating this problem.

“Any Port in a Storm: Vessel Activity and the Risk of IUU-Caught Fish Passing Through the World’s Most Important Fishing Ports,” a peer-reviewed study supported by The Pew Charitable Trusts and published in the *Journal of Ocean and Coastal Economics*, shows where fishing and carrier vessel activity is concentrated and which States are most at risk of having illegally caught fish passing through their ports and, therefore, where more effective implementation of the PSMA would have the greatest impact.

To quantify risk, researchers from Poseidon Aquatic Resource Management and OceanMind used Automatic Identification System (AIS) positional data transmitted by fishing and fish carrier vessels in 2017 to rank fishing ports in 140 coastal States based on the frequency of visits by foreign- and domestic-flagged vessels and the vessels’ hold size. They also created an assessment tool that uses indicators of internal and external risk factors to help gauge the likelihood of IUU-caught fish arriving in port and whether the State has sufficient policies and regulations in place to keep foreign vessels carrying this catch from entering port or using port services. An analysis of select individual ports found that not a single one has implemented all key PSMA provisions and that there is room for improvement all over the world. This process could begin with greater transparency of what measures port States have put in place and how effectively they are being enforced.

## **Port rankings based on vessel visits and hold size**

Most of the world’s geographic regions are represented in the top 10 ports ranked by foreign fishing and carrier vessel visits, foreign fishing vessel hold size, and foreign fish carrier vessel hold size, which researchers used to determine fleets’ fishing capacity. The areas missing in these top rankings are the coastlines of North America, the Middle East, and Australasia. The lack of prominent North American and Australasian ports is potentially because vessels flagged to countries in these regions generally return to the same domestic ports.

Researchers found that the top 10 ports in the world based on the number of visits by AIS-equipped fishing and carrier vessels are all Chinese. This finding is understandable because China’s large fishing fleet is primarily serviced by domestic ports; nearly all visits to these ports are by domestic vessels.

Many foreign fishing and carrier vessels with large hold sizes frequent the midocean ports of Majuro (Marshall Islands), Suva (Fiji), and Port Louis (Mauritius) to transship and unload tuna catches, activities that purse seine vessels in the Western and Central Pacific Ocean and Indian Ocean are not permitted to conduct on the high seas. European ports that are close to major fishing grounds are convenient landing sites for the European fleet. Examples include Las Palmas (Spain) in the lower Atlantic Ocean and Kirkenes (Norway) in the Barents Sea.

Busan (Republic of Korea) is frequented by many domestic and foreign vessels with sizable hold capacity, but 91 percent of the foreign visits are by vessels with Russian, Chinese, and Panamanian flags. Similarly, three flags—China; Taiwan, Province of China; and Republic of Korea—account for over 94 percent of foreign vessel visits to Suva.

The top 10 ports based on foreign fishing vessel hold size include both offload ports, where fishing vessels transship fish to fish carrier vessels, and terminal ports, where fish is landed for processing. They include the West African mainland ports of Abidjan (Ivory Coast), Walvis Bay (Namibia), and Nouadhibou (Mauritania), where many foreign fish carrier vessels also visit. The top 10 ports based on foreign fish carrier vessel hold size are mostly terminal ports. Among them is Bangkok (Thailand), which is frequented by fish carriers and receives about a quarter of global tuna harvests.

Table 1  
Total vessel visits

Rank	Port	Country	Visits
1	Zhoushan	China	59,830
2	Wenzhou	China	20,874
3	Lanshan	China	11,579
4	Rizhao	China	9,501
5	Dongshan	China	9,406
6	Quanzhou	China	8,826
7	Xiamen	China	7,649
8	Qingdao	China	6,842
9	Shanghai	China	6,834
10	Shantou	China	6,032

Table 2  
Number of foreign vessel visits

Rank	Port	Country	Visits
1	Busan	Republic of Korea	1,528
2	Majuro	Marshall Islands	1,168
3	Kirkenes	Norway	1,148
4	Nouadhibou	Mauritania	1,078
5	Suva	Fiji	983
6	Port Louis	Mauritius	957
7	Vila Real De Santo Antonio	Portugal	683
8	Manta	Ecuador	634
9	Dakar	Senegal	614
10	Las Palmas	Spain	601

Table 3  
Foreign fishing vessel hold size

Rank	Port	Country	Total m <sup>3</sup>
1	Majuro	Marshall Islands	943,000
2	Manta	Ecuador	761,748
3	Dakar	Senegal	561,418
4	Busan	Republic of Korea	545,080
5	Nouadhibou	Mauritania	468,553
6	Kirkenes	Norway	381,074
7	Walvis Bay	Namibia	375,292
8	Abidjan	Ivory Coast	335,405
9	Pohnpei	Federated States of Micronesia	331,692
10	Port Louis	Mauritius	319,985

Note: Total hold size is for all fishing vessels counted at that port

Table 4  
Foreign carrier vessel hold size

Rank	Port	Country	Total m <sup>3</sup>
1	Busan	Republic of Korea	4,152,292
2	Las Palmas	Spain	2,397,544
3	Dalian	China	1,943,959
4	Zhoushan	China	1,391,968
5	Kaohsiung	Taiwan, Province of China	1,299,084
6	Abidjan	Ivory Coast	1,002,135
7	Majuro	Marshall Islands	912,474
8	Rabaul	Papua New Guinea	908,397
9	Bangkok	Thailand	826,104
10	Pohnpei	Federated States of Micronesia	816,970

## Index of port State risk

The index assessing the risk that IUU-caught fish are passing through ports in each of 140 States combines the level of vessel traffic at the state's port, as detected by AIS, with indicators for internal and external risk factors. Examples include perceived levels of corruption as an indicator of internal risk and visits by vessels that are likely to be engaged in IUU fishing as an indicator of external risk. The full risk assessment criteria applied to each port State are shown below.

Table 5

### Underlying indicators for the Port State IUU Risk Index

Category	AIS-based	Priority	Indicator
General	Yes	n/a	1. Operates commercial ports in which fishing vessels do business
Internal	Yes	High	2. Number of commercial fishing ports
	No	Medium	3. Party to the PSMA
	No	Medium	4. Contracting party or cooperating non-contracting party of a regional fisheries management organization (RFMO) with a binding port State measures resolution and transparent compliance monitoring
	No	High	5. Compliance record with binding RFMO port State conservation and management measures
	No	Medium	6. Transparency International's Corruption Perceptions Index ranking
	No	Low	7. Status of the port State, identified by the EU*
	No	Low	8. Status of the port State, identified by the U.S.*
	No	Medium	9. Status of the port State, within any RFMO*
	External	Yes	Medium
Yes		High	11. Flag of Convenience State fishing vessels entering ports (plus vessels with an unknown Maritime Mobile Service Identity)
Yes		High	12. Average flag State governance index of fishing vessels entering ports±
Yes		High	13. IUU-listed fishing vessels entering ports
Yes		Medium	14. EU-carded flag State fishing vessels entering ports
Yes		Medium	15. U.S.-carded flag State fishing vessels entering ports
Yes		Medium	16. Average internal port State risk of fishing vessels entering ports (indicators 1-9)

Note: In this table, "fishing vessels" refers to fishing and carrier vessels.

\* Status indicates whether the port State has been identified or issued a warning by the European Union, the U.S., or an RFMO mechanism as an underperforming State.

± Average Transparency International Corruption Perceptions Index scores for the flag States of foreign vessels that entered given ports.





## Risk findings based on scoring

The IUU risk index in the report (shown in Figures 1 and 2) scores and ranks port States based on internal, external, and overall risks (which averages the two), with lower scores indicating lower risk. The global average internal risk score is 2.30, with the lowest score 1.21 for Grenada, and the highest 3.38 for both Papua New Guinea and Russia. The global average external risk score is 2.48 and falls between 1.76 for Antigua and Barbuda and 3.41 for both Russia and Venezuela. The global average for the overall risk score is 2.40, falling between 1.55 for Grenada and 3.39 for Russia.

Countries generally may appear as top performers in either internal or external risk categories, but rarely in both. Internal risks are distributed more evenly across the spectrum of scores between 1 and 3.5, while external scores are more concentrated between 2 and 3. This result indicates that the exposure to IUU risks differs between countries and regions, but that there is a greater difference between nations when considering how they have addressed the risk. Countries have more control over the extent to which they develop and apply port State measures than they do over external risk, which they can only partially mitigate through domestic policies.

Based on the index, regions can be ranked from high risk (left) to low risk, as follows:

Near East > Asia > Southwest Pacific > Africa > Latin America > Europe > North America

North America is the best performing region overall, followed by Europe. With the lowest average internal risk scores, most of these two regions' port States have adopted policies in line with the PSMA and are performing well within RFMOs, although the EU's and U.S.'s IUU compliance system for other countries might slightly bias the analysis in their favor. Asia and the Near East are the worst performing regions, with internal risks being more important in the Near East, and external risks—typically related to weak controls by flag States—in Asia. The latter result is not surprising because Asia has globally important seafood markets and receives a large volume of very different vessels from diverse flag States.





Figure 1a  
Internal Risk Scores



Top 5 internal risk scores

Score	Country
1.21	Grenada (GRD)
1.31	Slovenia (SVN)
1.44	Sao Tome & Principe (STP)
1.50	Belgium (BEL), Uruguay (URY)
1.56	Albania (ALB), Finland (FIN), New Zealand (NZL), Sweden (SWE)

Bottom 5 internal risk scores

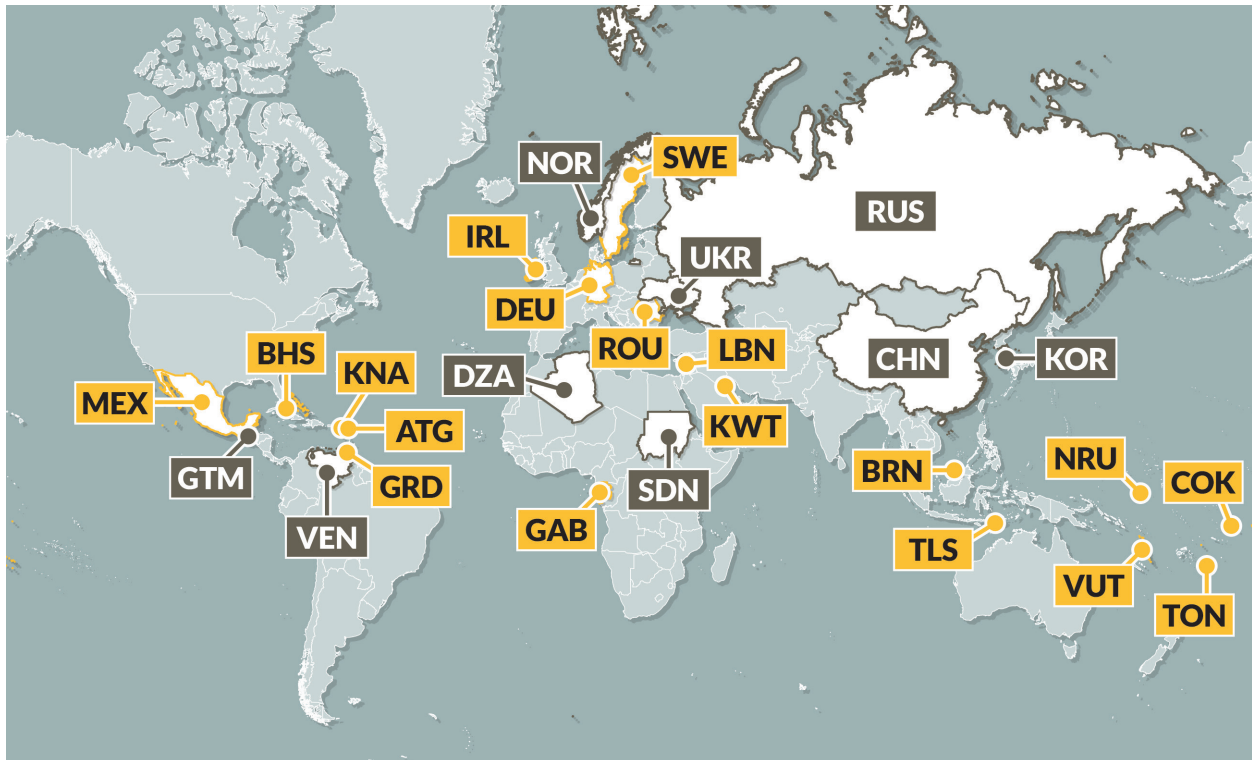
Score	Country
3.06	Mexico (MEX)
3.08	Iraq (IRQ), Democratic People's Republic of Korea (PRK), United Arab Emirates (ARE)
3.15	Bahrain (BHR), Democratic Republic of the Congo (COD), Republic of the Congo (COG), Dominican Republic (DOM), Kuwait (KWT), Solomon Islands (SLB)
3.31	Vietnam (VNM)
3.38	Papua New Guinea (PNG), Russia (RUS)

Note: The internal risk score evaluates if a country has measures in place to mitigate IUU risks. The three letters after each country's name is the code used by the International Organization for Standardization.

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Figure 1b  
External Risk Scores



Top 5 external risk scores

Score	Country
1.76	Antigua & Barbuda (ATG)
1.88	Cook Islands (COK), Grenada (GRD), Saint Kitts & Nevis (KNA), Vanuatu (VUT)
1.94	Mexico (MEX), Romania (ROU)
2.00	Sweden (SWE), Tonga (TON)
2.06	Bahamas (BHS), Brunei Darussalam (BRN), Gabon (GAB), Germany (DEU), Ireland (IRL), Kuwait (KWT), Lebanon (LBN), Nauru (NRU), Timor Leste (TLS)

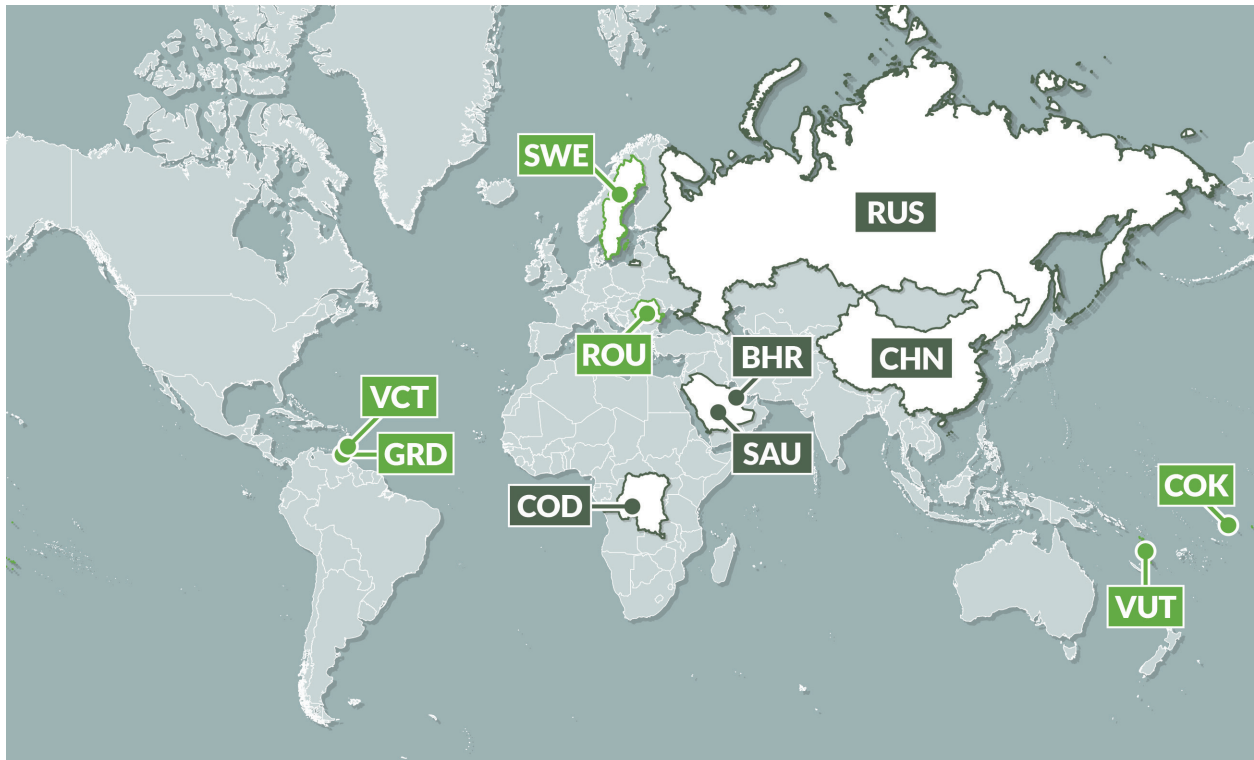
Bottom 5 external risk scores

Score	Country
3.06	Guatemala (GTM), Republic of Korea (KOR), Ukraine (UKR)
3.12	Algeria (DZA), Norway (NOR)
3.18	Sudan (SDN)
3.29	China (CHN)
3.41	Venezuela (VEN), Russia (RUS)

Note: The external risk score evaluates risks associated with IUU fish-carrying vessels attempting to enter ports. The three letters after each country's name is the code used by the International Organization for Standardization.

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Figure 1c  
Overall Risk Scores



Top 5 overall risk scores

Score	Country
1.55	Grenada (GRD)
1.69	Saint Vincent and the Grenadines (VCT)
1.78	Sweden (SWE), Romania (ROU)
1.83	Cook Islands (COK)
1.85	Vanuatu (VUT)

Bottom 5 overall risk scores

Score	Country
2.97	Saudi Arabia (SAU)
2.99	Democratic Republic of the Congo (COD)
3.08	China (CHN)
3.15	Bahrain (BHR)
3.39	Russia (RUS)

Note: The internal risk score evaluates if a country has measures in place to mitigate IUU risks. The external risk score evaluates risks associated with IUU fish-carrying vessels attempting to enter ports. The three letters after each country's name is the code used by the International Organization for Standardization.

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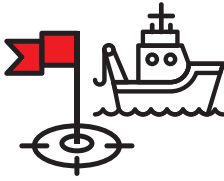
Table 6  
 Ranking of world regions across risk categories

Rank	Internal risk score	External risk score	Overall risk score
1	Europe (2.06)	Southwest Pacific (2.31)	North America (2.24)
2	North America (2.06)	North America (2.41)	Europe (2.27)
3	Africa (2.22)	Latin America & Caribbean (2.42)	Latin America & Caribbean (2.35)
4	Latin America & Caribbean (2.26)	Near East (2.47)	Africa (2.40)
5	Asia (2.48)	Europe (2.48)	Southwest Pacific (2.41)
6	Southwest Pacific (2.51)	Africa (2.54)	Asia (2.54)
7	Near East (2.68)	Asia (2.59)	Near East (2.65)



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## Risk Assessment Findings



### **When internal port State risk rises, external risk rises:**

Fishing vessels in poor standing tend to avoid ports of States with strong port controls, so these States face less risk from visiting foreign vessels.

### **PSMA parties have lower internal and external risk scores:**

Adherence to the PSMA either leads to improvements in adopting port State measures in general, or the adherence is a result of the port State making such improvements.

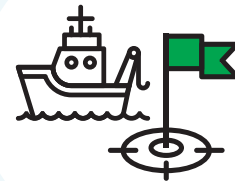


### **Governance quality is a determining factor of port State performance:**

Countries that are perceived to be more corrupt were found to have less effective measures in place to counter the risk of IUU fish entering their ports—and more exposure to this risk.

### **Port States with low internal risk are visited by vessels flagged by States with low internal risk:**

As a port State's governance improves, it is more likely to be visited by vessels whose flag States have strong governance.



### **Country income is an important factor in determining port State performance:**

Except for countries in Asia and the Near East, higher-income countries generally take more measures to mitigate the risk of IUU catch entering their ports.





## Deeper analysis of selected ports

Researchers selected 14 fishing ports, two from each of the seven major Food and Agriculture Organization (FAO) regions, for further analysis. In each region, researchers sought to select ports from countries with different income levels and a mixture of tuna and non-tuna ports, landing and transshipment ports, and ports with domestic or foreign vessel dominated port entries. They examined how well both the port and the State have adopted port State measures, and the identity information of fishing and carrier vessels observed on AIS visiting the port. As in the case of the port State analysis, evaluation of the port risk could assess only the frameworks and measures that were found to be in place, rather than how they were implemented in practice.

While the individual ports were found to not necessarily be representative of their country's or their region's performance—except by chance—not a single one has implemented all key PSMA provisions.

- Only three port States appear to have formally designated ports for entry for foreign fishing vessels through national legislation.
- Public records of past vessel movements could only be located for four ports.
- Ports and/or States had few information resources—including lists of designated ports and applicable PSM rules—and those resources that they did have were poor.
- The only positive result: 10 ports required advance notification and authorization for entry.

Given the representative mix of ports that researchers further examined, it is clear that States and individual ports have work to do to put key PSMA provisions in place. Information resources and publicizing of such resources, through the FAO where indicated (a key treaty provision), remain limited.

## Recommendations

The following are key recommendations for States. A full list of recommendations is in the report.

### Recommendations for the use of AIS

1. As a cost-effective way to monitor fisheries, governments should consider requiring that AIS systems be tamper-proof to prevent operators from manipulating their vessel's position and identity. The mandate would make AIS usage as reliable as vessel monitoring systems.
2. To make it easier to determine whether a vessel is operating legally in a given area, countries should publish national registries, keep vessel records up to date—including the Maritime Mobile Service Identity (MMSI) for all authorized vessels required to have AIS—and provide vessel data to the FAO for inclusion in its “Global Record of Fishing Vessels, Refrigerated Transport Vessels and Supply Vessels.”
3. Flag States should mandate that fishing vessels and carriers leaving their waters use AIS, and port/coastal States should require foreign-flagged vessels entering their waters to also use the tracking technology.

### Recommendations for Port States

1. Port States should formally designate ports that foreign vessels may enter and ensure that robust prior notification and authorization regimes are put in place.
2. Port States that have ratified the PSMA should submit relevant PSM information to the FAO for public hosting, including the information related to designated ports.
3. Port States should develop a national PSMA-themed web portal that gives third parties access to comprehensive resources regarding port State rules, designated ports, port entry conditions, forms, and contacts, and should ensure that all port authorities operate websites that are easy to locate through a simple web search.

In addition, the FAO should enhance its information systems and publish more data on how its members are implementing the PSMA, including data that goes beyond the minimum required by the PSMA, if States make it available.

## Conclusion

While the study found important differences in how well regions are mitigating their risk of illegal catch entering their ports and markets—and how exposed they are to vessels carrying IUU products—it also shows that every region harbors weak and strong performers. Much progress remains to be made in translating key PSMA provisions into national practice, starting with the designation of ports and making information about these measures publicly available.

By showing not only how IUU risk is distributed, but how it relates to factors such as income and corruption, the study also demonstrates that these non-fisheries issues may hamper a State's ability to carry out its treaty obligations. The assessment findings make clear, however, that if a State improves its compliance, it will likely be less exposed to high-risk vessels—providing a solid argument in favor of fully implementing the PSMA.

## Methodology

This study builds upon a previous assessment by Poseidon in 2015, “Fish Landings at the World’s Commercial Fishing Ports,” which ranked the world’s top 100 ports by volume of commercial fish landed by any industrial-scale vessels.

In this new study, researchers from OceanMind and Poseidon combined AIS with other data sources to build indicators to determine port risk. They analyzed AIS records from 2017 to identify when fishing vessels and fish carriers stopped within 12 nautical miles of shore anywhere in the world. These stops were algorithmically grouped to represent port visits and linked to locations that represent commonly used ports and anchorages. The hold capacity of the vessels, and whether they were domestic or foreign, was used to classify over 3,000 ports and anchorages worldwide.

AIS data considerations:

- Larger vessels are more likely to carry AIS transmitters and to be detected by AIS receivers. This bias increases the confidence of the findings related to foreign visits, but underestimates domestic port arrivals by smaller, local vessels.
- While AIS is not compulsory in all States, some countries and regions, for example, the U.S. and Europe, flag more fishing vessels operating on AIS because of regulations making AIS compulsory for certain vessel sizes.
- Several regions frequently generate poor AIS data due to the limited number of terrestrial receivers and high traffic density (e.g., Strait of Malacca and the English Channel) or because operators turn off AIS to reduce the risk of pirate attacks (e.g., near Somalia).
- The poor quality of some transmitted AIS data (e.g., invalid positions, multiple vessels sharing a single AIS identity, and vessels transmitting insufficient identity information to distinguish them as harvesters or fish carriers) led researchers to exclude some of it from the analysis. AIS data quality problems are more common in Asia.

Given the variable satellite coverage and AIS use and data quality, this analysis does not capture every fishing vessel in the world, even those fitted with functioning AIS transponders.

There are limitations to applying algorithmic analysis globally when ports in different countries/regions have their own characteristics. Some events were inappropriately associated with a specific port, some events indicating a vessel stopping could not be grouped within a single visit to a port, and researchers may have overcounted port visits at the State level. There were many visit events that could not be assigned to a port listed in the World Port Index and were categorized as visits to unknown ports or unknown anchorages, but only 8.5 percent of foreign-flagged visits were to unknown locations. These issues probably minimally affected the global analysis because effects tend to cancel out over larger areas.

The ranking of ports, especially those based on the hold size, must be used carefully, as these values are estimates and should be used for comparative purposes only. The ranking based on hold size is obviously of great interest because it represents the aggregate potential for the loading, unloading, or transshipment of fish, but should not be interpreted as an estimate of the volume of landings or transshipment in port.

Of the 153 coastal States selected for this study, researchers eliminated 13 because no AIS-fitted fishing vessels could be detected entering ports (Barbados, Belize, Bosnia and Herzegovina, Cambodia, Dominica, Eritrea, Haiti, Honduras, Jordan, Monaco, Nicaragua, Niue, and St. Lucia). Of the 140 coastal States identified as operating fishing ports based on AIS data, three did not have any visits by foreign AIS-detected vessels (Bahrain, Comoros, and St. Vincent and the Grenadines). Some of the coastal States that were eliminated, for example, Barbados and Cambodia, are clearly port States, providing an early indication of some of the limitations generated by the low rate of AIS technology use across fishing fleets globally.

The quality of the non-AIS source data used for indicators is reliable and is determined by the processes applied by the individual organizations producing and hosting these data. When discrepancies were found between style and content of information from different sources, researchers took a conservative bias to ensure that countries did not receive better scores than they should have.

## Endnotes

- 4 Africa, Asia, Europe, Latin America and the Caribbean, the Near East, North America, and the Southwest Pacific.
- 5 Vessels on a list of fishing vessels such as regional fisheries management organizations (RFMO) authorization lists or self-reporting as a fishing vessel on AIS.
- 6 The World Port Index is a dataset produced by the U.S. National Geospatial Intelligence Agency that includes major global ports and can be accessed at [https://msi.nga.mil/NGAPortal/MSI.portal?\\_nfpb=true&\\_pageLabel=msi\\_portal\\_page\\_62&pubCode=0015](https://msi.nga.mil/NGAPortal/MSI.portal?_nfpb=true&_pageLabel=msi_portal_page_62&pubCode=0015).

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