



Automatic Identification System Spoofing

Automatic Identification System (AIS) is a vessel tracking system that transmits information like a vessel's location and identity. This includes the name, unique vessel identifier, callsign, size, flag state, and type of the vessel, along with its speed, direction, and geographical position. Manipulation of AIS devices is a rare occurrence and detectable by publicly available platforms like Global Fishing Watch (GFW)¹, which tracks human activity at sea in part through AIS.

What is AIS Spoofing?

- **Spoofing** is the manipulation of a vessel's AIS device to hide or alter a vessel's location or identity. This generally refers to manipulation with ill intent. For example, a vessel operator could enter a false Maritime Mobile Service Identity (MMSI) number to appear as a different vessel (identity spoofing) or change their coordinates (location spoofing).
- Intentional spoofing typically occurs when a vessel is engaged in illegal, unreported, and unregulated (IUU) fishing activities as vessel operators try to disguise their true activity.
- Spoofing is an uncommon occurrence and accounts for less than a quarter of one percent of AIS signals received, according to GFW.
- There are cases of involuntary identity or location misrepresentation. For example, some flag states may reassign MMSIs, but miss a vessel. The unassigned vessel may use an MMSI number that they believe is their MMSI with no intent of hiding their identity. Involuntary location misrepresentations can also occur when signal congestion causes errors in transmission or when there is external Global Navigation Satellite Systems interference.

How is spoofing detected?

- MMSI are unique vessel numbers commonly used by AIS devices. This number is voluntarily entered into AIS devices by vessel operators. The first 3 digits of the string of nine numbers are the Maritime Identification Digits (MID) which acts as a country code. Both numbers can be used in identity spoofing detection.
- Identity spoofing occurs when more than one vessel broadcasts the same MMSI simultaneously. Vessel operators that want to hide their identity may alter this number. Some false or invalid MMSI numbers are more commonly used and detected in multiple vessels that simultaneously broadcast the same identity. For instance, an identity spoofing vessel can use a MID that does not match the estimated 290 country codes, seem nonsensical (i.e., 123456789), or have a MID that is followed only by zeros.
- For identity spoofing detection, GFW checks other vessel information for each MMSI. Inconsistencies in identifying information for an MMSI, like ship names, can confirm identity spoofing when it is broadcast during overlapping time periods and MMSIs.
- GFW detects location spoofing by 1) manually inspecting maps for any vessel tracks that overlap with land or exhibit clear manipulation, 2) using the information about the satellite that receives the AIS signal and calculating the distance between signal receipt



and vessel position, 3) leveraging satellite imagery, like Sentinel-1, to confirm suspected spoofing for large vessels, and 4) using queries that remove specific and known location spoofing patterns, like the switching of true latitudes and longitudes.

- Examples of location spoofing that can be detected by GFW include when a large fishing vessel appears to travel across that state of Colorado in the United States or when AIS messages for an MMSI are repeatedly and significantly farther away from the satellite that receives those messages. Additionally, if a 100-meter vessel does not appear in satellite images of the region that a vessel reports itself, it is marked as location spoofing.

Why is AIS an important contribution to a culture of transparency?

- AIS is invaluable for transparency and monitoring, as it allows fisheries managers and authorities to detect suspicious and illegal behavior. NGOs such as GFW use AIS data collected from satellites to map fishing activities across the world's oceans. Fisheries managers and others can use this publicly available information to track compliance with regulations and make informed decisions regarding management and enforcement of marine resources.
- With an increase in publicly available vessel movement data, more vessels can be monitored remotely and flagged for potentially suspicious activity. With location and vessel information provided through AIS devices, vessels that are fishing in prohibited areas (i.e., marine protected areas) or potentially masking their behaviors by turning their AIS devices off can be identified.
- The transparency of knowing where vessels are, and what they are doing, brings illegal behavior to light and discourages environmentally, economically, and socially harmful fishing practices. This can include anything from foreign vessels illegally entering the United States' Exclusive Economic Zone and stealing fish, to fishing fleets pillaging endangered species in marine protected areas.

What does Oceana recommend?

- To further increase transparency, maritime domain awareness, and safety at sea, Oceana recommends the U.S. to:
- **Expand existing AIS requirements to transmit for the duration of the voyage:** Amend the requirements to explicitly require AIS transmission throughout the vessels' entire time at sea.
- **Require fishing vessels 49 feet or longer to transmit AIS using Class A devices:** Following the EU requirements, require all U.S. fishing vessels 49 feet (15 meters) or longer to carry and transmit AIS in the U.S. EEZ and on the high seas.
- **Notification of all AIS-off events:** Require U.S. vessels to notify the Coast Guard when a fishing vessel operator stops transmitting AIS within four hours of the halt in transmission.



- **Require all U.S. fishing vessels to be equipped with Class A AIS devices:** Because of coverage gaps with Class B AIS devices, the United States should remove the exemption in 33 C.F.R. § 164.46(b)(2)(i) to facilitate enhanced vessel monitoring with the stronger Class A device.

¹ Global Fishing Watch, a provider of open data for use in this article, is an international nonprofit organization dedicated to advancing ocean governance through increased transparency of human activity at sea. The views and opinions expressed in this article are those of the authors, which are not connected with or sponsored, endorsed or granted official status by Global Fishing Watch. By creating and publicly sharing map visualizations, data and analysis tools, Global Fishing Watch aims to enable scientific research and transform the way our ocean is managed. Global Fishing Watch's public data was used in the production of this publication.

Any and all references to "fishing" should be understood in the context of Global Fishing Watch's fishing detection algorithm, which is a best effort to determine "apparent fishing effort" based on vessel speed and direction data from the Automatic Identification System (AIS) collected via satellites and terrestrial receivers. As AIS data varies in completeness, accuracy and quality, and the fishing detection algorithm is a statistical estimate of apparent fishing activity, therefore it is possible that some fishing effort is not identified and conversely, that some fishing effort identified is not fishing. For these reasons, GFW qualifies all designations of vessel fishing effort, including synonyms of the term "fishing effort," such as "fishing" or "fishing activity," as "apparent," rather than certain. Any/all GFW information about "apparent fishing effort" should be considered an estimate and must be relied upon solely at your own risk. GFW is taking steps to make sure fishing effort designations are as accurate as possible.