Global Fishing Watch

# Our digital ocean

**Transforming fishing through transparency and technology**

Just a decade ago, building an accurate picture of the commercial fishing across the globe would have been impossible. Today, thanks to advances in satellite technology, cloud computing and machine learning, Global Fishing Watch is making it a reality.

## So how do we do it and what difference does it make?

### 1. Harvesting the data

The process starts with vessel tracking data. While Global Fishing Watch uses several vessel tracking systems, we start with the automatic identification system (AIS), a GPS-like device that large ships use to broadcast their position in order to avoid collisions. The International Maritime Organisation and many national governments require larger boats including many commercial fishing vessels to use AIS. Each year, more than 300,000 unique AIS devices broadcast the location of a vessel along with other information showing its identity, course and speed. Ground stations and satellites pick up this information, meaning a ship's movements can be followed even in the remotest parts of the ocean.

While only a small fraction of the world's roughly 2.9 million fishing boats carry AIS, they are responsible for a disproportionate amount of the fish caught, especially far from shore. It's estimated vessels with AIS account for over half the fishing effort more than 100 nautical miles from shore, and as much as 80% of the fishing in the high seas.

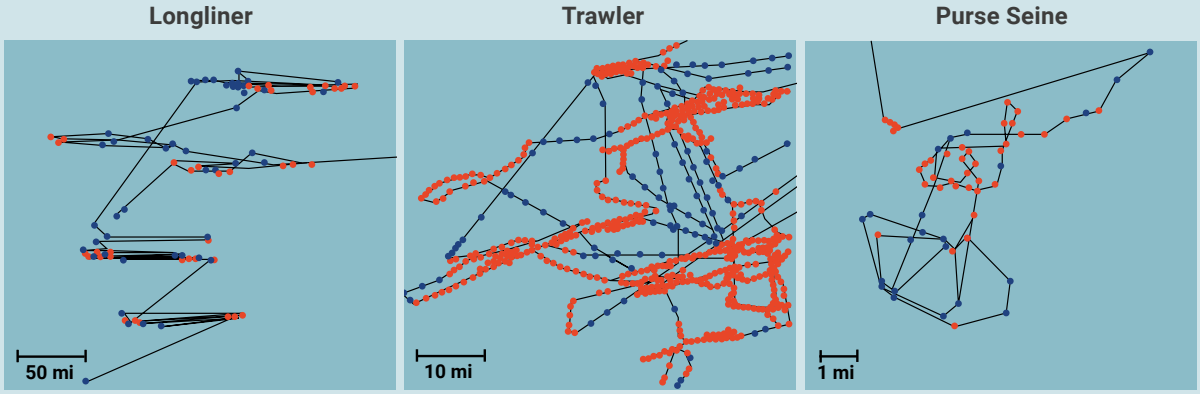
### 2. Processing the information

AIS provides vast amounts of publicly available data – it's far too much for any human being to make sense of and only part of it is from fishing boats.

Global Fishing Watch runs this data through two neural networks using computer algorithms to learn and look for patterns in large data sets. More than 60 million points of information per day from more than 300,000 vessels are fed through machine-learning classifiers to determine the type of ship (e.g., cargo, tug, sail, fishing), its size, what kind of fishing gear (e.g. longline, purse seine, trawl) it's using and where and when it's fishing based on its movement patterns. To do this, our research partners and fishery experts have manually classified thousands of vessel tracks to "teach" our algorithms what fishing looks like. By using cloud computing to spread the load over thousands of machines in parallel, we're able to apply that learning to the entire dataset producing 37 billion points over five years.

## Vessel tracks

Global Fishing Watch can give a clear indication of where, when and how a vessel fishes by analysing its movements.




**The orange dots and lines indicate when the vessel is actively fishing and the blue when it is moving between fishing areas.**

© Joy Leighton

**"Global Fishing Watch is transformative. It's going to make a huge difference in how we understand what's happening in the ocean and how we manage activities that affect the health of the ocean."**

**Dr. Jane Lubchenco, world renowned environmental scientist and marine ecologist**

---

### 3. Sharing the results

Global Fishing Watch makes this vessel tracking information available to all through our interactive online map and downloadable data. Anyone with an internet connection can trace the movements of more than 65,000 commercial fishing boats, along with their name and flag state, in near real time: our data shows all activity from 1 January 2012 until 72 hours ago. You don't need to be an expert to use the platform, any more than you need to know about complex algorithms to use a search engine: it's aimed at members of the public and journalists as much as researchers, campaigners and governments. Users can create heat maps to see patterns of commercial fishing activity, view tracks of individual vessels and overlay information like the locations of marine protected areas or different countries' exclusive economic zones (EEZ).


## Catching out the identity cheats

Most large fishing vessels are assigned a unique Maritime Mobile Service Identity (MMSI) number, but in practice some vessels use a number that is not assigned to them — either a false number (like 123456789) or the number of another vessel. This means that, throughout the ocean, multiple vessels are simultaneously broadcasting the same MMSI number making them indistinguishable from one another without closer inspection. Vessels can also manipulate their GPS location by tampering with the system ("spoofing").

Our machine-learning algorithms automatically separate signals coming from multiple vessels using the same MMSI, and also detect when the broadcast location is inconsistent with the location of the satellite that received the signal. We can't always determine the true identity of the spoofing vessel, but our algorithms can still detect the vessel's behaviour and put it on a map.

## Opening up research

The Global Fishing Watch Research Programme brings together 11 leading institutions from around the world. By combining Google tools, methodologies and datasets in a collaborative environment, they're modelling economic, environmental, policy and climate change implications on fisheries at a scale not otherwise possible. Our Research Accelerator Programme also supports a growing community of dozens of researchers performing queries across our full five-year (and counting) dataset. They use the data in different ways, to explore, for example, the interaction between individual boats and albatross on the high seas, patterns of fishing activity around seamounts and the impact of China's annual 4.5-month moratorium on fishing.


© Hasvold Photography

**"Every time I show the live map to somebody, they tell me something I didn't know. In five seconds it can tell stories that never could have been told before."**

**Brian Sullivan, co-founder of Global Fishing Watch and Senior Programme Manager for Google Earth Outreach.**

---

## Making an impact

The technology powering the Global Fishing Watch map may be impressive, but the really exciting stuff happens when people use it:

**Governments** can identify and take action against boats that aren't authorised to fish in their waters or that are fishing illegally in protected areas

**Seafood suppliers and retailers** can see where and how fish are caught and ensure they only source from boats that are operating legally and responsibly

**Researchers** can study the impacts of fishing on ocean health, identify vulnerable areas, investigate how environmental changes influence where fish go or evaluate the effectiveness of conservation and fisheries policies

**NGOs and journalists** can identify and investigate suspicious vessels and advocate for stronger protection for important ecosystems

**Fishers** can show that they are operating legally and responsibly, giving them a market advantage by enabling them to sell their catch to customers who demand sustainable, traceable seafood

## Global Fishing Watch and marine protected areas

The Government of Kiribati used Global Fishing Watch data to show that an industrial purse seiner was fishing illegally in the Phoenix Islands Protected Area, an important site for tuna where commercial fishing is banned. The boat's owners, the Central Pacific Fishing Company, received a US$1 million fine, and also agreed to pay a further US$1 million grant to the Pacific island nation.

Global Fishing Watch data is not only helping with monitoring marine protected areas, it's also helping make the case for new reserves. National Geographic's Pristine Seas project has used our data to help establish five no-take reserves in the past two years: Clipperton Atoll (a French territory in the Pacific), Niue in the South Pacific, Revillagigedo archipelago in Mexico, and the Juan Fernández archipelago and Cape Horn in Chile.

### Spreading our net: new partnerships and technologies

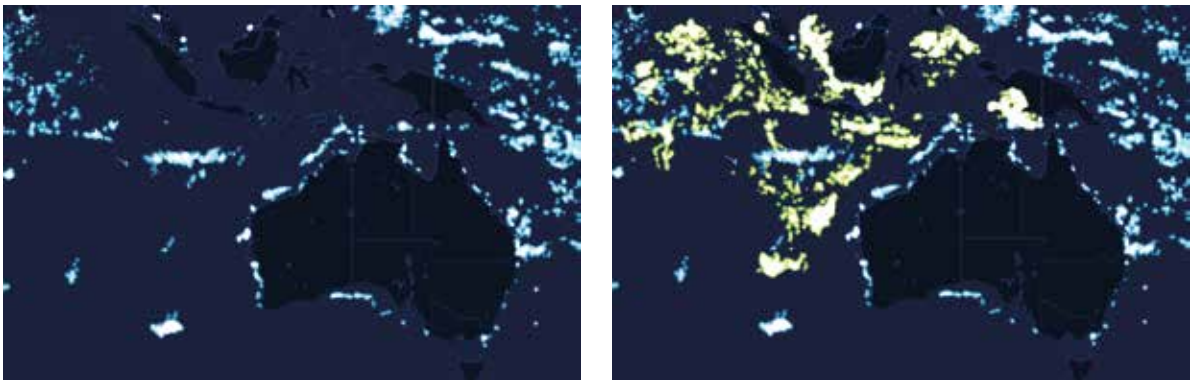
While AIS offers an unprecedented global view of fishing, it doesn't cover all fishing boats and it can be tampered with. So we're collaborating with a growing number of countries to include data from other sources, such as government-operated vessel tracking systems.

In 2017, Indonesia became the first nation to make its proprietary vessel monitoring system (VMS) tracking data available via Global Fishing Watch, instantly putting 5,000 smaller commercial fishing vessels that don't use AIS on our map. In October 2018, Peru made its vessel tracking data publicly available for the first time through Global Fishing Watch. Costa Rica has also committed to publicly sharing its VMS data.

We're also working to include more data on small-scale fishing activity, and have conducted pilot programmes to ensure our platform remains open to new tracking systems. For instance, we've been able to display data from a partnership between Bali Seafood, the largest exporter of snapper from Indonesia, and Pelagic Data Systems, manufacturers of cellular and solar-powered tracking devices. Innovations like this can bring the same transparency to small-scale and artisanal fishing vessels as with large industrial vessels.

Additionally, we're including data from infrared imaging, that is capable of detecting light emitted by vessels fishing at night, and radar systems, that use radio waves to image the Earth's surface. Imaging-based systems can detect vessels that have no tracking device or that may try to hide by turning off their tracking. We're also open to including emerging technologies such as radio-frequency detections and full-motion video from satellites.

Integrating this information will enable us to build up an even more accurate and comprehensive picture of global fishing activity: our ambition within the next 10 years is to be capable of detecting, revealing and analysing fishing activity responsible for up to 90% of the world's marine catch.



Before and after: Vessels tracked with AIS data (seen in light blue in the left image).The addition of Indonesia's VMS data instantly put 5,000 smaller commercial fishing vessels on the map (seen in yellow on the right image) that don't use AIS.

Explore our data and find out more at **globalfishingwatch.org**

Global Fishing Watch