联合国粮食及农业组织 | Food and Agriculture Organization of the United Nations | Organisation des Nations Unies pour l'alimentation et l'agriculture | Продовольственная и сельскохозяйственная организация Объединенных Наций | Organización de las Naciones Unidas para la Alimentación y la Agricultura | منظمة الأغذية والزراعة للأمم المتحدة

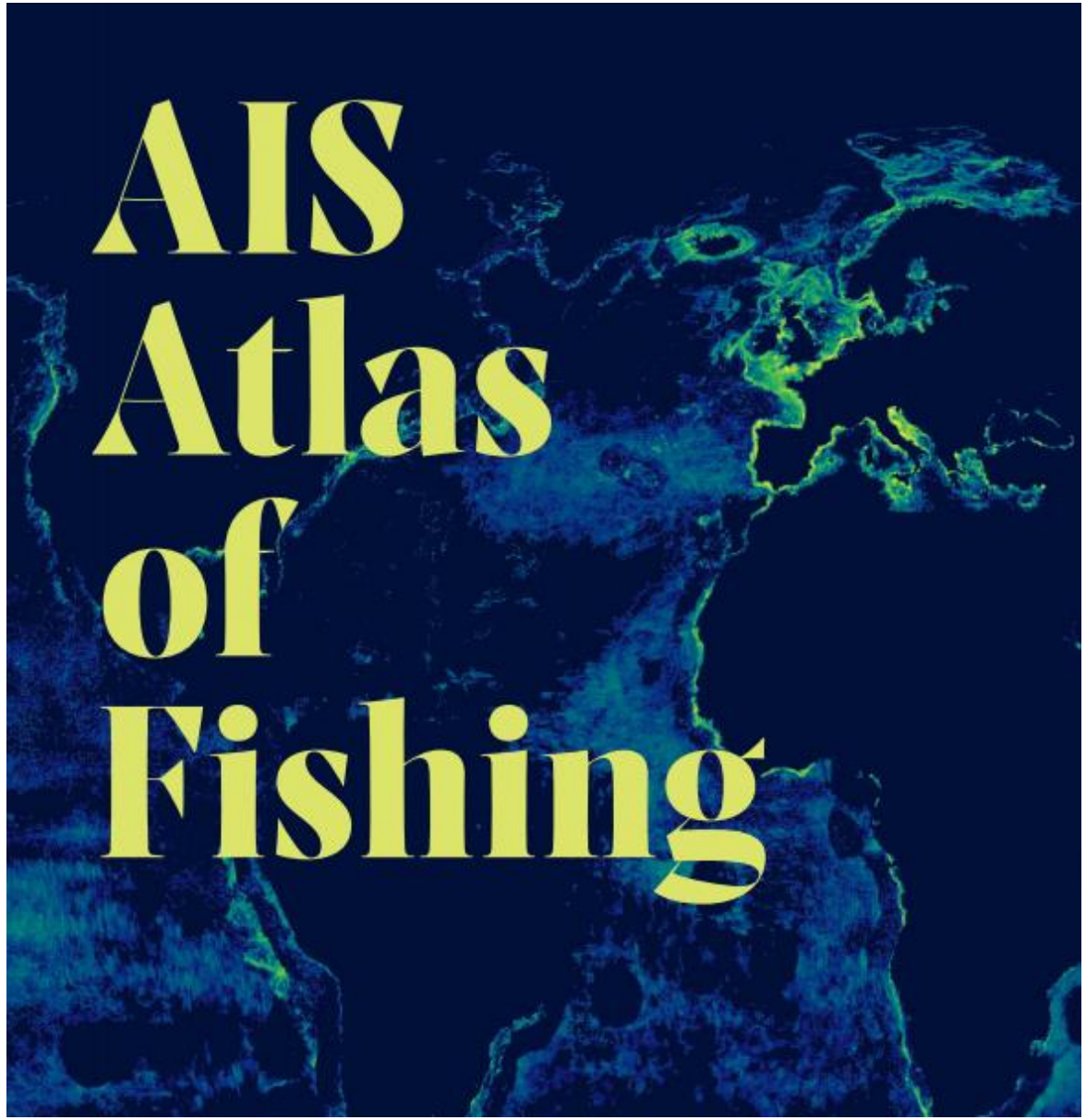
COORDINATING WORKING PARTY ON FISHERY STATISTICS
Twenty-sixth Session

Rome, Italy, 15-18 May 2019

FAO AIS-based Atlas of fishing footprint and effort

CWP-IS/2019/Pr10

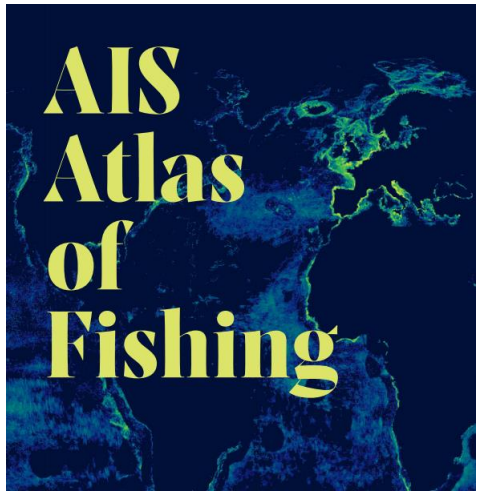
Author: Marc Taconet, Jennifer Gee



Food and Agriculture Organization of the United Nations

Global Fishing Watch

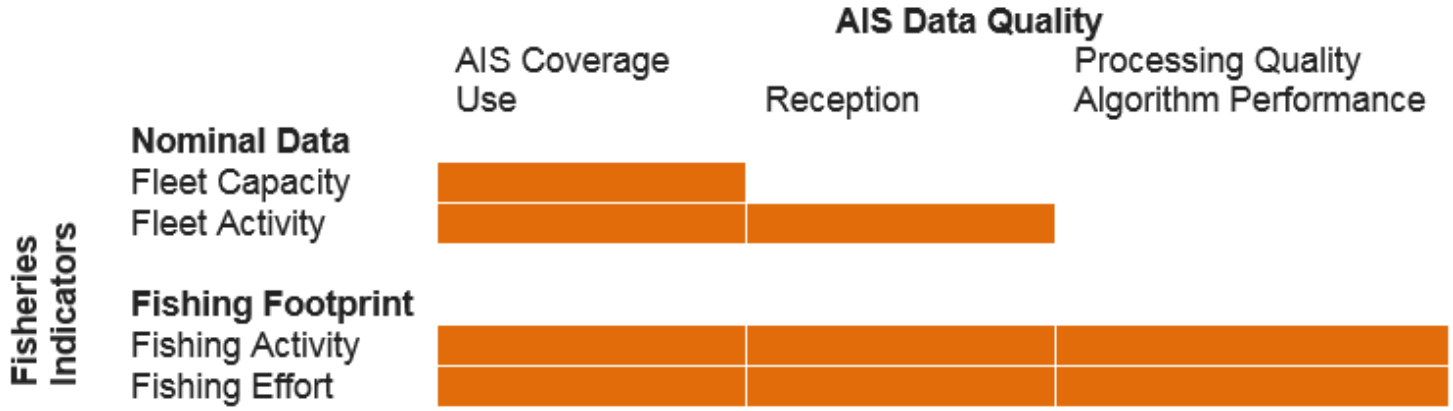
azti tecnalia



The aim of the Atlas is twofold:

1. to provide an initial proxy to fishing footprint with a range of data quality from presence/absence of activity through to the intensity of fishing activity by primary gears.
2. to identify the opportunities for use and best application of AIS data as well as the limitations and scenarios where caution around use is needed

Mapping AIS and fishery indicators concepts

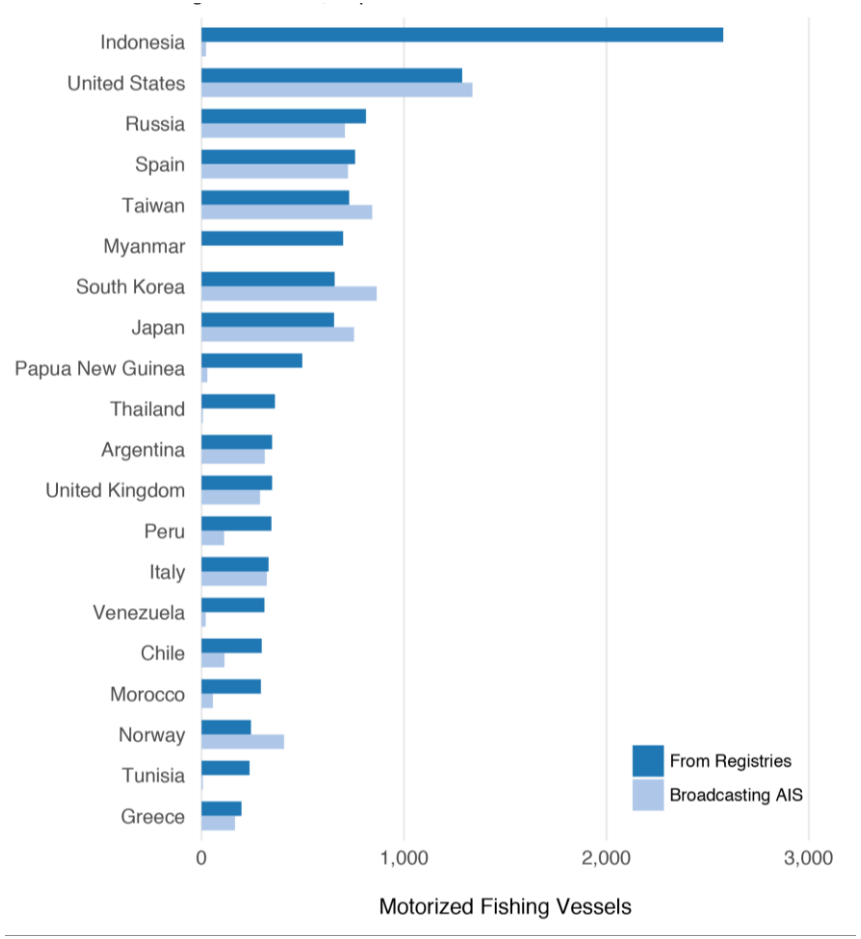


Quick Notes:

Data coverage and data quality depend on:

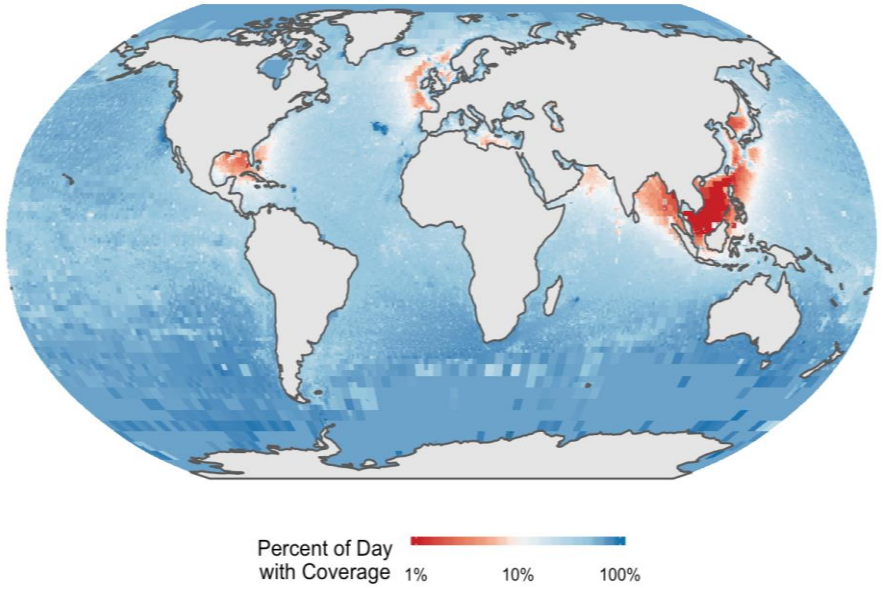
- AIS use – which vessels are using AIS - which fraction of fleet is equipped with AIS
- AIS reception – how well are receivers (satellite or shore receivers) able to receive the emissions
- AIS processing – how well the algorithms correctly identify gear types, fishing activity, hotspots, etc.

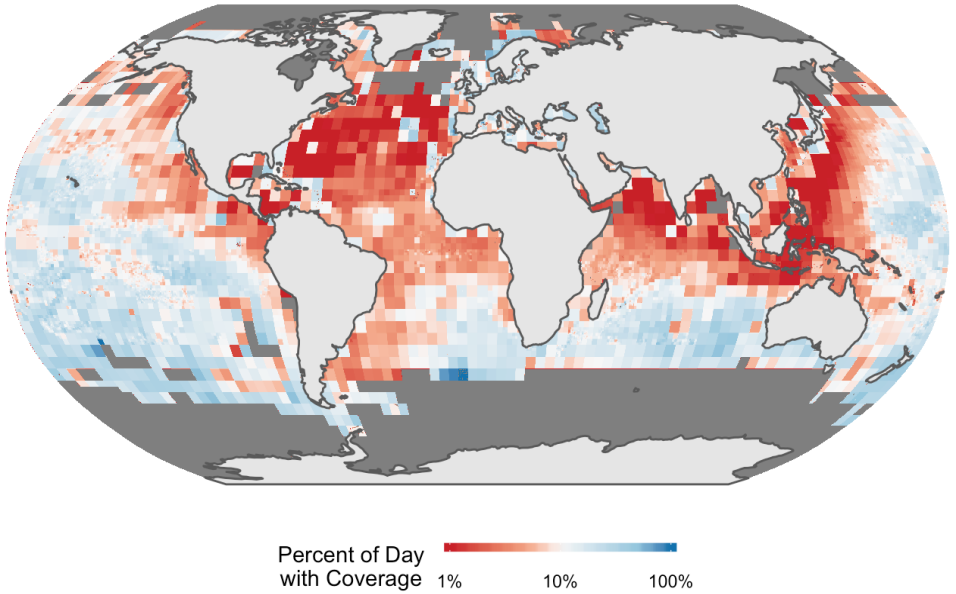
AIS use by country



Number of vessels by country is from FAO fleet statistics or a review performed by Global Fishing Watch. Number of vessels broadcasting AIS and their lengths are estimated by matching vessels to registries and identifying vessel characteristics through a neural net classifier.

AIS reception





***Quick notes*:**

On the ability to monitor Presence/absence of fishing activity through AIS:

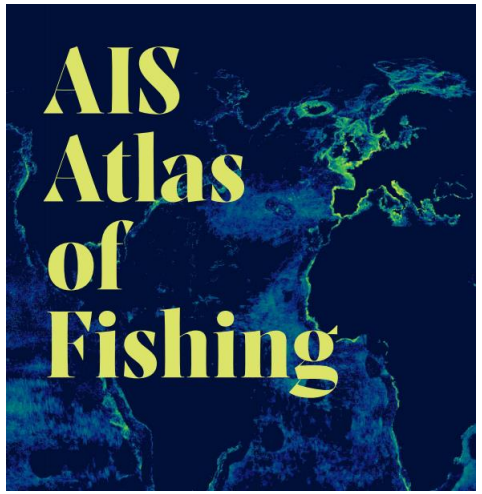
- Beyond AIS use, the capacity to monitor fishing activity through AIS depends on the class of equipment used: high quality AIS using satellite communication (Class A), lower quality AIS using terrestrial relays (Class B). Reception of AIS for Class A is generally good, reception of AIS for Class B varies geographically and is very sensitive to the amount of vessels traffic. As a result offshore and Open high seas regions are generally well covered, while coverage in coastal areas varies with some areas being very blind to AIS such as SouthEast Asia.
- A further criteria which prevents AIS from monitoring is the switch–off behaviour or lowering of AIS transmission power.

AIS for Monitoring regional fleet activity

Quick Notes:

- AIS will generally identify in a region all vessels which make use of the device, hence provide the number of AIS-identified active vessels by flag state in a region.
- The capacity to categorize by size class and gear type depends on capacity to match AIS identifiers with vessel registries informed by size and gear type, and of the AIS reception coverage in the concerned region
- *Limitation: China? With strange behaviors on MMSI (unique identifier for AIS signal)*

Country	Number of unique likely fishing MMSI	% matched to registry	% with length	% with gear type
China	24,841	4.1	4.4	3.2
United States	2,426	85.9	52.7	34.5
Norway	2,206	95.9	75.9	3.1
Spain	1,705	84.3	82.8	83.5
Korea	1,651	15.3	14.5	14.4
Italy	1,470	90.4	89.6	90.1
Taiwan	1,320	53.3	52.1	49.7
Japan	1,235	72	27.1	29.4
United Kingdom	1,167	87.4	46.4	61.3
France	986	97.1	83.6	87.4
Iceland	937	78.4	64.8	20.7
Russia	655	94.2	85.6	78.8
Turkey	570	90.7	41.9	34.9
Canada	549	94.9	31.3	23.9
Netherlands	530	84.7	25.3	26.4
Denmark	443	78.1	0.2	7.2
Portugal	407	96.3	95.1	95.6
Greece	337	99.4	77.7	79.8
Argentina	322	94.1	0.6	1.9
Hungary	239	97.9	79.9	80.8



The Atlas includes chapters on each of the FAO regions and two in-depth case studies for the Seychelles and Bay of Biscay where the AIS data is confronted with logbook & VMS data.

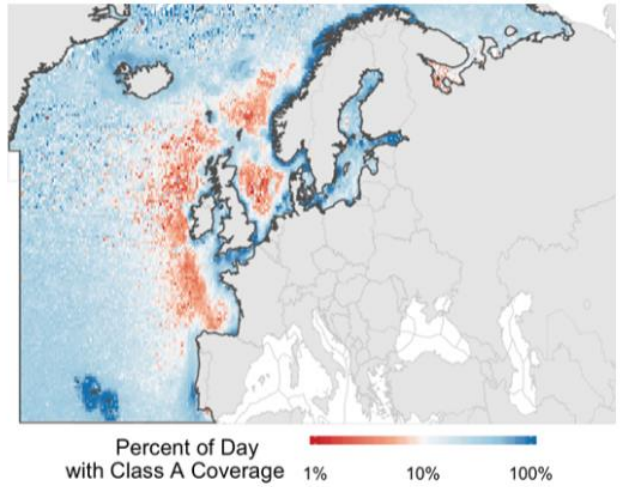


Figure 3.d.i.x1. AIS coverage in North Atlantic (FAO area 27) during 2017.

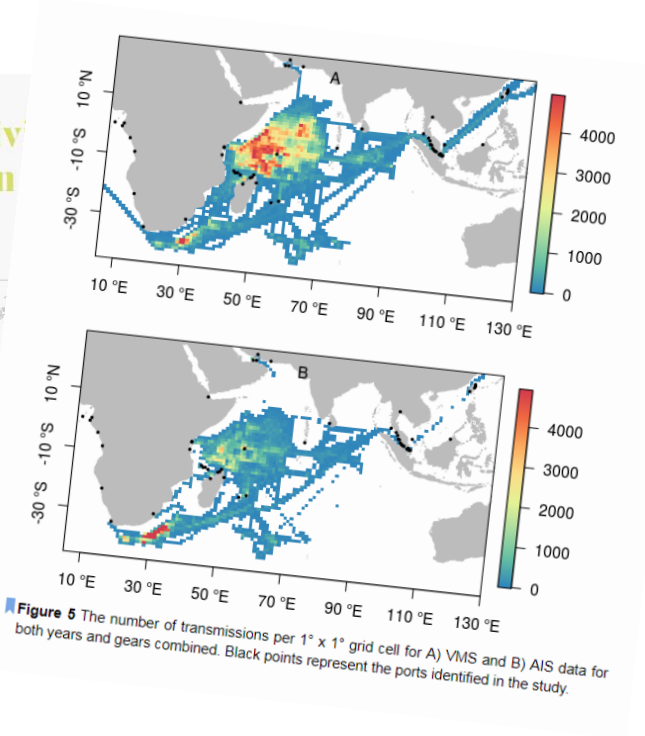
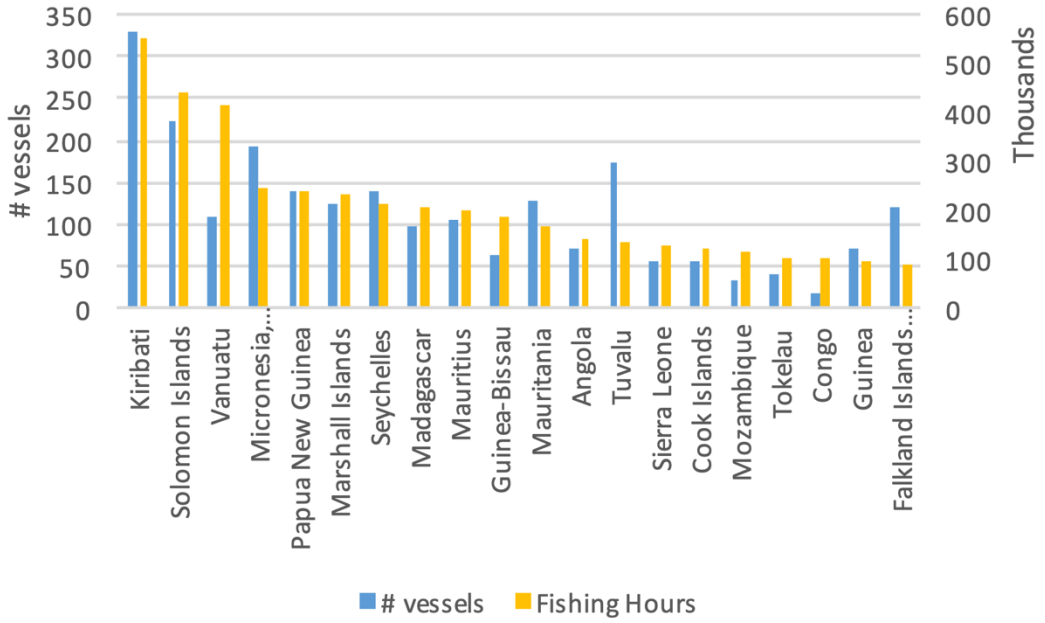
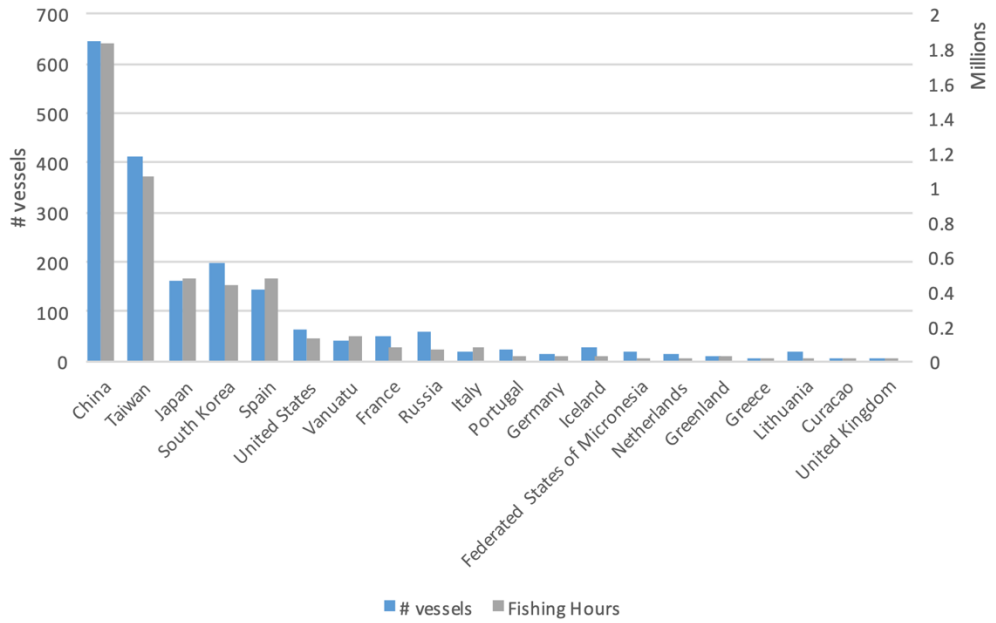


Figure 5 The number of transmissions per 1° x 1° grid cell for A) VMS and B) AIS data for both years and gears combined. Black points represent the ports identified in the study.

AIS for Monitoring regional fleet activity



Top EEZs Fished by Distant Water Fleets, 2016-2017

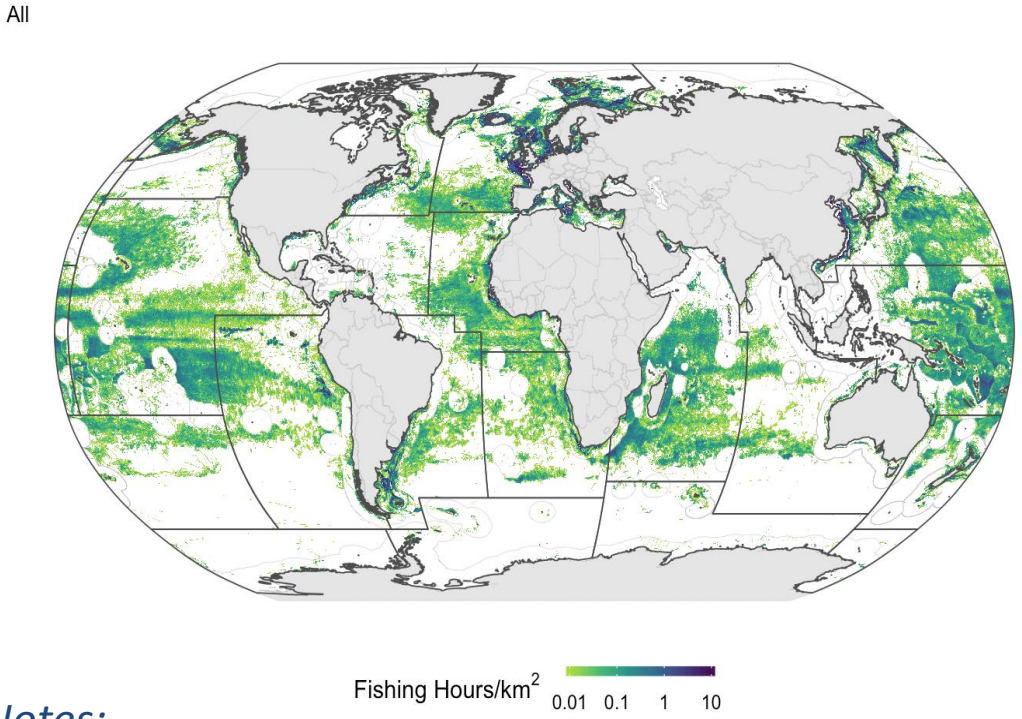


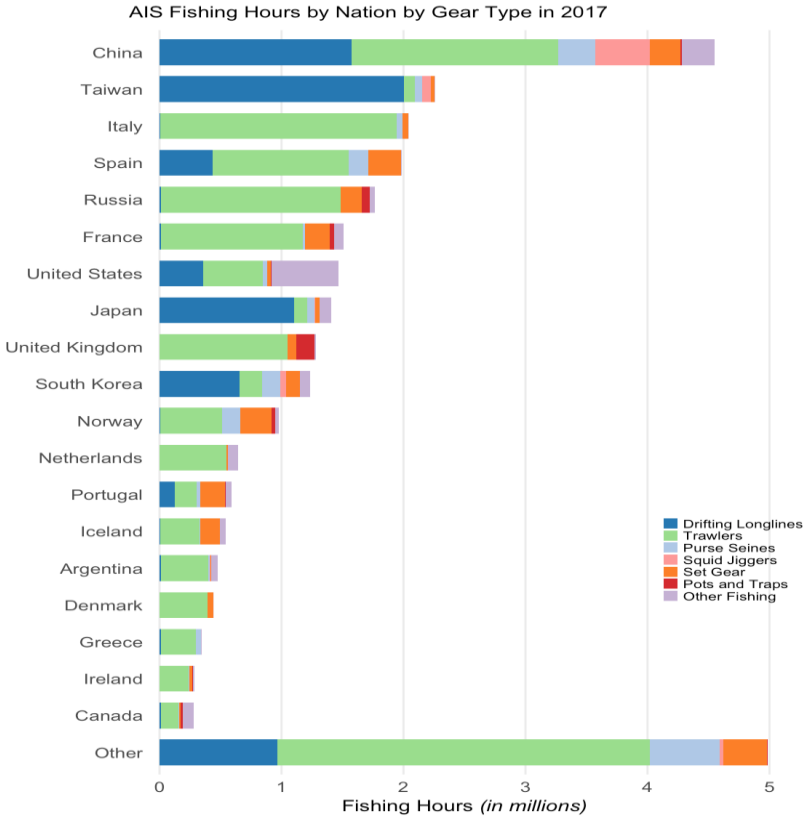
Top Distant Water Fleets, 2016-2017

Quick Notes:

- *AIS will generally identify in a region all vessels which make use of the device, hence provide the number of AIS-identified active vessels by flag state in a region.*
- *The capacity to categorize by size class and gear type depends on capacity to match AIS identifiers with vessel registries informed by size and gear type, and of the AIS reception coverage in the concerned region*
- *Limitation: China? With strange behaviors on MMSI (unique identifier for AIS signal)*

Monitoring of AIS Footprint in terms of spatial distribution patterns and hot spots of fishing



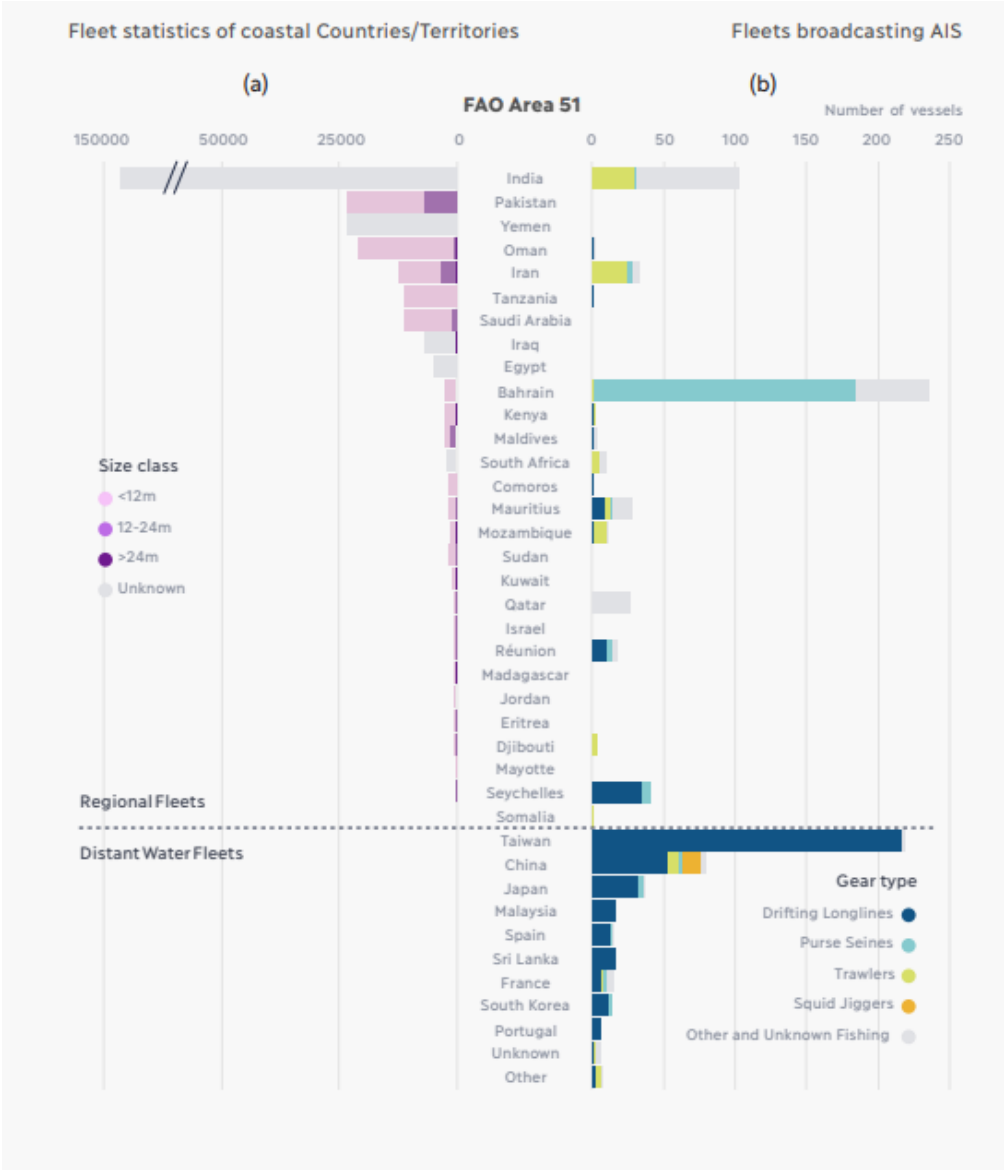


Quick Notes:

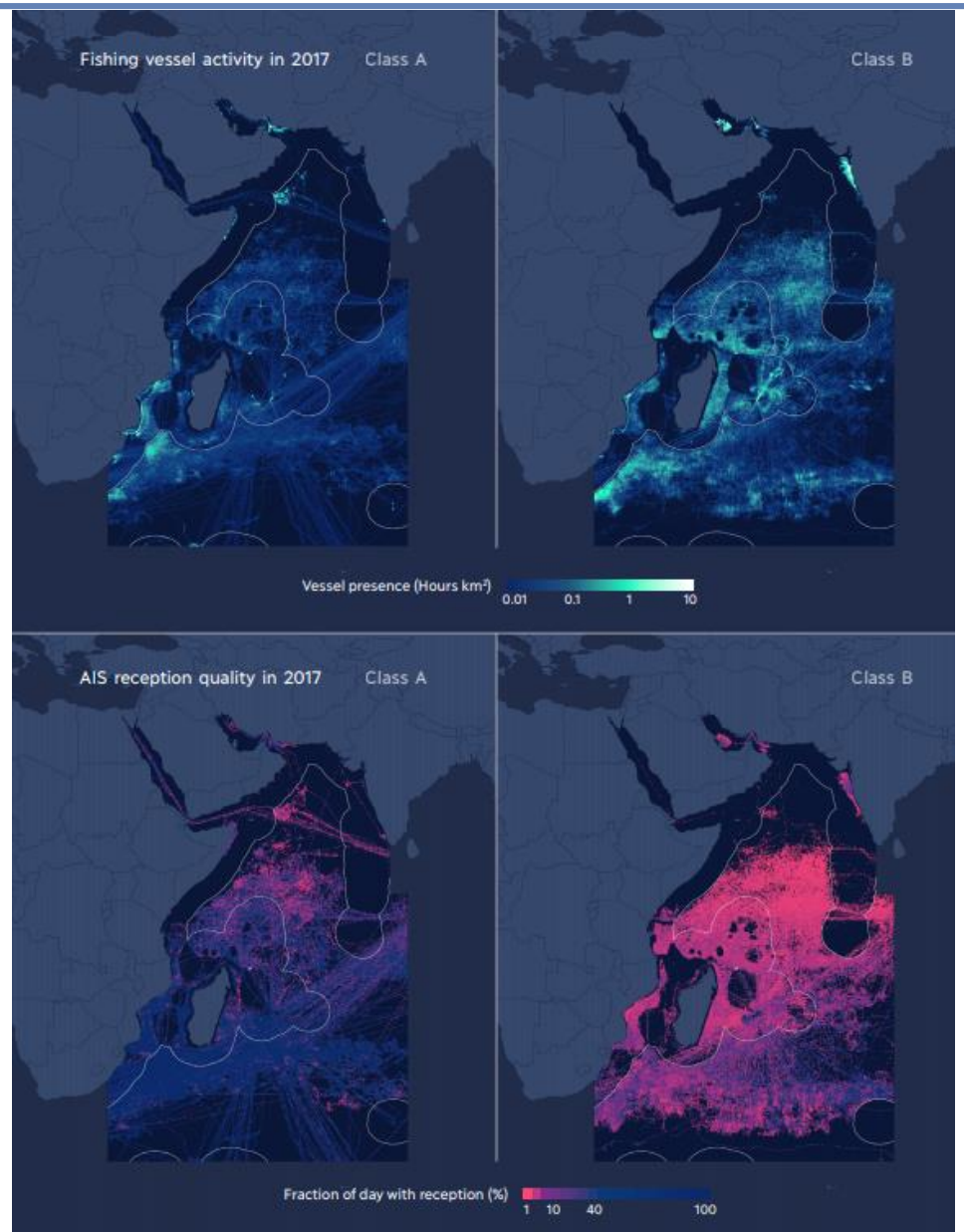
In areas where AIS is minimally used and AIS reception is good, the spatial distribution patterns (fishing footprint in terms of intensity, and hot spots) can be reasonably well modelled and represented for few main gear categories, but the accuracy of the classification algorithm depends on the number of AIS-identified vessels which could be matched with records in vessel registries with knowledge of main gear type (Longline, Purse seine, Trawl, …). Thus the quality of the fishing footprint by gear type depends highly on availability of vessel registries

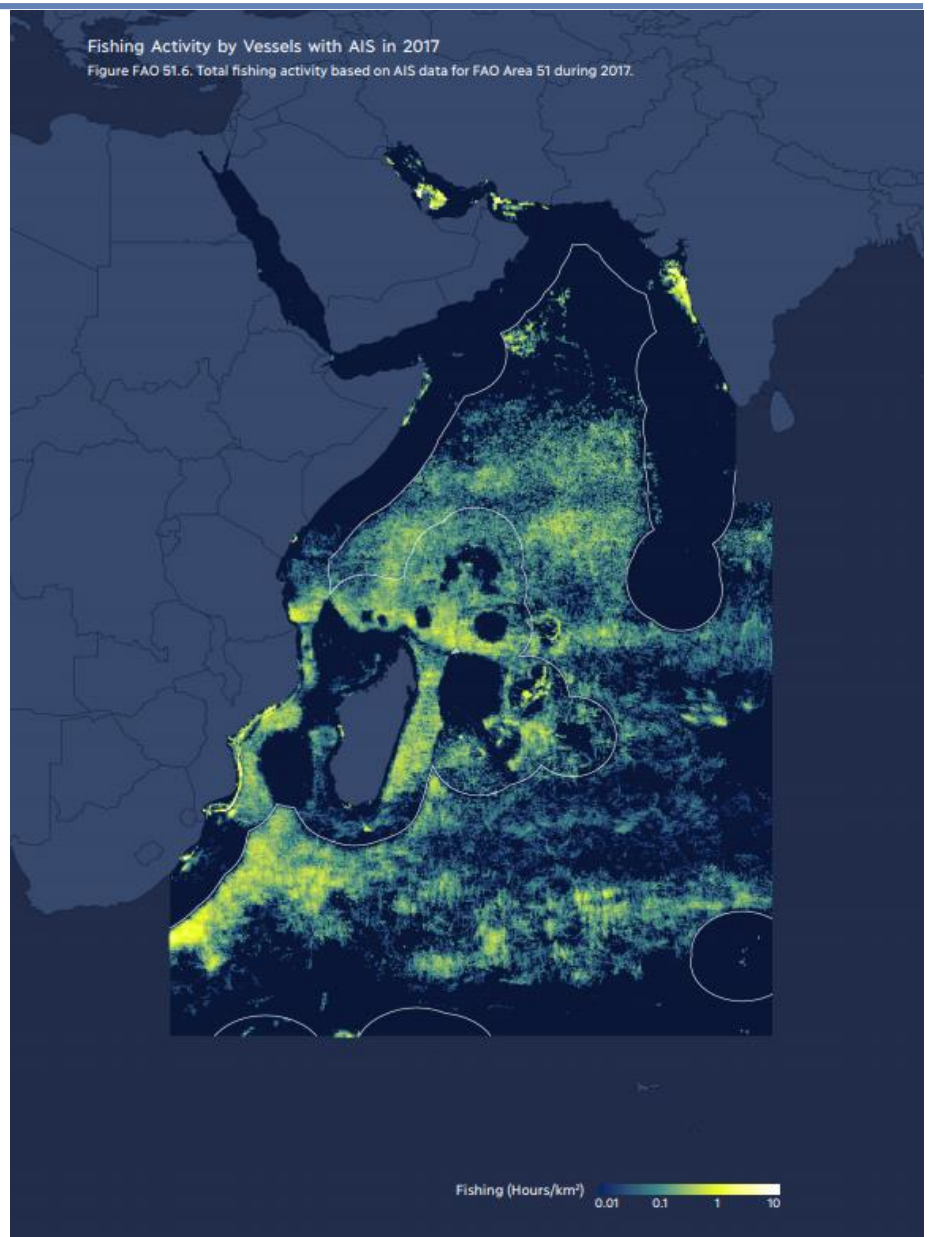
FAO AREA 51

AIS based fishing activity in Western Indian Ocean

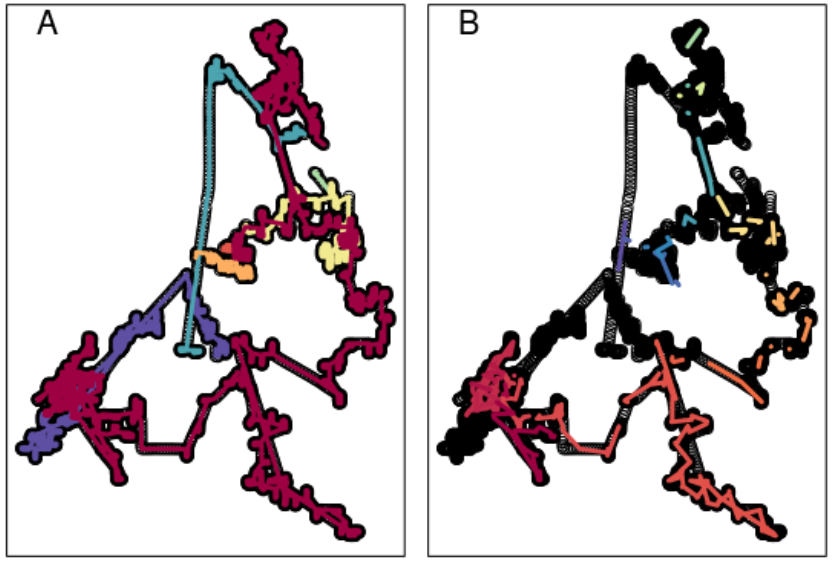


AIS Reception Region 51

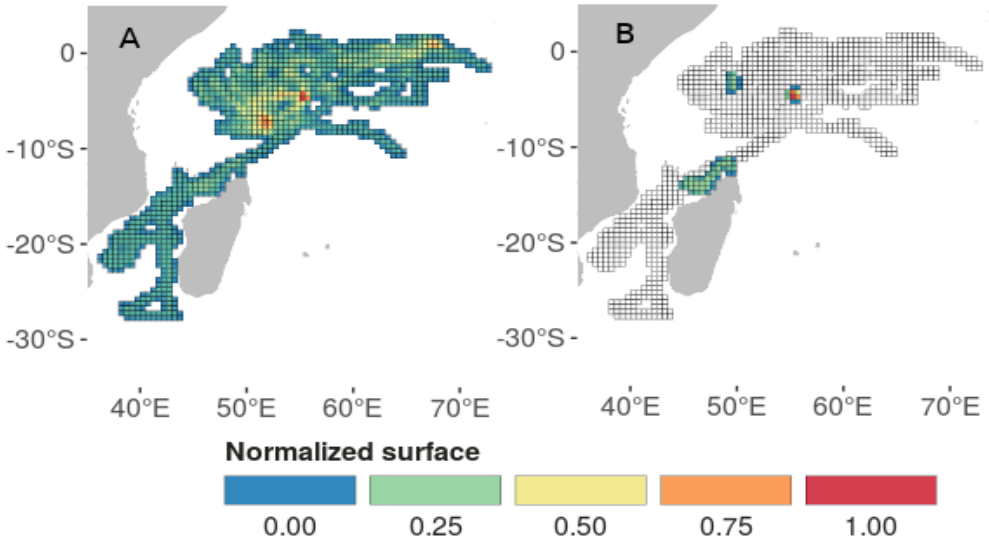




Monitoring fishing activity / estimating Fishing Effort with AIS



An example from the Seychelles longlines trajectories calculated from long line A) VMS data (N trajectories = 7) and B) AIS data (N trajectories = 65). Black points on both plots are VMS transmissions. The overlaid different colored lines represent different trajectories



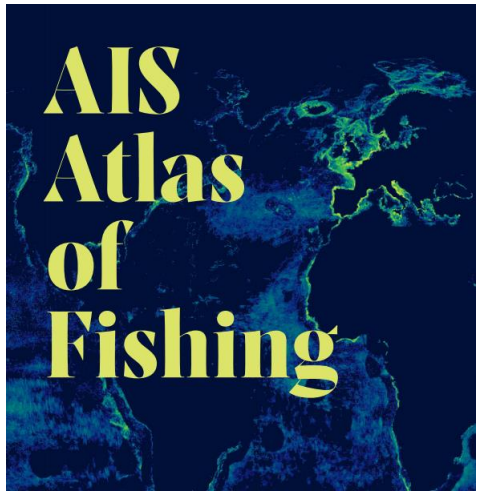
The normalized surface explored by Seychelles purse seine vessels in May 2017 as calculated by determining the surface area from the length of the vessel trajectories with a buffer of 38 km around the trajectory. Surface area is aggregated over the month for each cell for A) AIS and B) VMS data. Higher values indicate that more surface area was explored in a cell.

Quick Notes:

- Works better with Longlines or Trawling gear types, while limited for Purse seiner and other or mixed gear types
- In optimal conditions (majority of vessels using AIS, good reception and no switch-off), state of the art is that AIS algorithm produces reasonably good estimation of fishing activity for certain gears such as Longline or Trawling, while not yet satisfactory for other gears such as Purse seines, and is generally unable to distinguish gear used in multi-gears vessels/activity (set gillnets, trolling, pole and line, traps, …), or subtle variants of fishing practices for same gear in same region and flag state (small pelagic purse seining, big pelagic purse seining; bottom trawl vs pelagic trawl)
- In optimal conditions where AIS use and reception coverage are good, and where good vessel record registries – with gear type - AIS algorithm can perform well for certain gears to the point of being able to provide good estimates of fishing effort (e.g. certain gears in region 27)

Relevance to SDG agenda – SDG 14.4.1

- Effort statistics
- More available with geographic breakdown
- For better estimation of Catch per Unit Effort
- Concerning industrial fleets, can reasonably be used on a fleet x fishery basis for estimating effort within EEZs separate from effort outside EEZs …
- And catch statistics
- … which in turn can be used for separate estimates of catches within and outside EEZs



For discussion

How much of the world's fishing activity is by vessels with AIS?
How representative is the catch by vessels in this Atlas of the global catch?

Unfortunately, there is no easy way to answer these questions…

- AIS tracks only a small percentage of the world's fishing vessels, but these vessels are responsible for disproportionate amount of the world's catch.
- The accuracy and validity of data provided by AIS varies widely depending on the region, AIS coverage, gear type and state of registry data
- Combining AIS with vessel registries including gear types will increase the value of AIS
- Combining AIS with VMS and logbooks raises very good prospects of improving estimates of fishing effort
- Combining AIS with global inventory of fisheries would provide an estimate of AIS capacity to assess world fisheries