

Preferential Access Zones in Small-Scale Fisheries

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Independent Study for Xavier Basurto – internal report for IHH report

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Methodology

Identifying countries with Exclusive fishing zones for small-scale fisheries

There are total 58 countries selected in this study, as they are the countries included in the Illuminating Hidden Harvest (IHH) Project in FAO. To identify countries that have designated marine areas for the exclusive harvesting of their small-scale fishing fleets, we accessed three sources of information: 1) Empirical data produced by the IHH project. Those data are collected based on the answers from fishing experts in each country about the question whether the country has exclusive small-scale fishing zone, and the legal/geographic information that they know about the small-scale fishing zone. 2) a preliminary report on the empowerment of small-scale fishing and small-scale fishermen generated by FAO. The legislative information in this report are collected based on the literature review of FAOLEX database. 3) FAOLEX database, which contains the legislation profiles of each country.

For the purpose of this research, only laws in “Fisheries” category were included. The laws were reviewed first by title, and determined whether they are relevant to the country’s general fishery regulation. The abstract, along with the keywords of the legal documents were scanned next to find any information that are related with artisanal/small-scale fishery. For those that pass the second examination, the actual documents were carefully read, with concentration in looking for and determining the geographic information of the artisanal/small-scale fishing zone. For the legal documents that are not in English, the Google document translate was used to assist in locating the key information for this research. Sometimes, for countries that do not have geographic information found in the legislations from FAOLEX database, additional literature review process was conducted. The key words (such as the country name and “small-scale fishery”) were typed into the search box of Google, with the most relevant and reliable search result (such as academic paper and scientific report) were carefully examined like the process above. China, Gabon, Senegal, and Sri Lanka were examined through this additional literature review process. If none of the information were found based on literature review process, expert consultations for specific country were conducted. This final process allowed determining whether a specific country had exclusive small-scale fishing zones or not.

Mapping

Once the countries were identified I built models to produce maps in ArcGIS pro. The countries were generally categorized into two categories (Table 1). The main data source to map the exclusive small-scale fishing zones in first category (nautical miles from coast) comes from the Marine Regions, which is an online geodatabase that contains an integration of VILIMAR Gazetter and the VLIZ maritime boundaries. The downloaded shapefiles contain the geographic information of the legal marine boundaries for each country, like territorial sea and exclusive economic zone. The data are then selected and processed for each country

within unique geographic models that built in ArcGIS pro. The data source to map the exclusive small-scale fishing zones in the second category (bathymetric depth) comes from GEBCO gridded bathymetric data, which is a global terrain model for ocean and land at 15 arc-second intervals (~500 meters). Like the process to map the countries in first category, the GEBCO gridded bathymetric data are then selected for each country, and processed in specific geographic models that built in ArcGIS pro.

Result


Countries with exclusive small-scale fishing fell into two categories: 1) countries that designated certain # of nautical miles from the marine baseline (either normal or straight baseline that marks the low-water line of the coastal state) as the exclusive small-scale fishing zone, and 2) countries that designated certain bathymetric depth to define the exclusive small-scale fishing zone. There are also countries that have different standards for exclusive small-scale fishing zones (like designate marine protected area) other than those two categories stated above. However, for the current stage of this research, only the countries belong to the two categories stated above were mapped.

Table 1: country categorization based on small-scale fishing zone designation

Country	Political Level of Definition	Definition of Boundaries	Units of Definition
Bangladesh	Country-wide	Bathymetric depth	40m deep line (at high tide)
Cambodia	Country-wide	Bathymetric depth	20m deep line (at high tide)
Ghana	Country-wide	Bathymetric depth/Distance from the coast	30m isobath or 6 nautical miles offshore whichever is further
Mexico	Country-wide	Bathymetric depth	5 fathom depth (~9m)
Chile	Country-wide	Distance from the coast	5 nautical miles
China	Country-wide	Distance from the coast	12 nautical miles
Gabon	Country-wide	Distance from the coast	3 nautical miles
Greenland	Country-wide	Distance from the coast	3 nautical miles
Liberia	Country-wide	Distance from the coast	6 nautical miles
Mauritania	Country-wide	Distance from the coast	3 up to 9 miles
Mozambique	Country-wide	Distance from the coast	3 nautical miles
Nigeria	Country-wide	Distance from the coast	5 nautical miles
Norway	Country-wide	Distance from the coast	12 nautical miles
Peru	Country-wide	Distance from the coast	5 nautical miles
Senegal	Country-wide	Distance from the coast	6 nautical miles
Seychelles	Country-wide	Distance from the coast	12 nautical miles
Sri Lanka	Country-wide	Distance from the coast	40 kilometers
Spain	Country-wide	Distance from the coast	12 nautical miles
Thailand	Country-wide	Distance from the coast	3 nautical miles
India	By Province	Distance from the coast	1) Tami Nadu: 3 nautical miles 2) Andhra Pradesh: 8 kilometer 3) Odisha: 5 kilometer 4) West Bengal: 15 kilometer 5) Andaman and Nicobar island: 6 nautical miles
Sierra Leone	Country-wide	Distance from the coast defined by coordinates	1) Point 1: 9.0506 (Lat) -13.4003 (Long) 2) Point 2: 8.5 (Lat) -13.3847 (Long) 3) Point 3: 8.0686 (Lat) -13.3192 (Long) 4) Point 4: 7.5681 (Lat) -13.1347 (Long) 5) Point 5: 7.2839 (Lat) -12.6019 (Long) 6) Point 6: 7.1003 (Lat) -12.25 (Long) 7) Point 7: 6.8342 (Lat) -11.5356 (Long)

- Territorial Sea: As defined by the 1982 United Nations Convention on the Law of the Sea, territorial sea is a belt of coastal water extending at most 12 nautical miles from the baseline (the low-water mark) of a coastal state
- Continental Shelf: As defined by the 1982 United Nations Convention on the Law of the Sea, the continental shelf of a coastal State comprises the seabed and subsoil of the submarine areas that extend beyond its territorial sea throughout the natural prolongation of its land territory to the outer edge of the continental margin or to the distance of 200 nautical miles from the baselines from which the breadth of its territorial sea is measured where the outer edge of the continental margin does not extend up to that distance.
- Economic Exclusive Zone (EEZ): As defined by the 1982 United Nations Convention on the Law of the Sea, EEZ is the area which a sovereign state has special rights regarding the exploration and use of marine resources, including energy production from water and wind

Table 2: Area for Legalized Marine Regions and Exclusive Small-scale Fishing Zone

Country	Exclusive SSF Area (km2)	Territorial Sea (km2)	Continental Shelf Area (km2)	Economic Exclusive Zone (km2)
Bangladesh	32781.13	9201	65546	112166
Cambodia	4374.71	5180	47676	48697
Chile	61476.47	136301	755915	2488052
China	143002.00	143002	1028908	963556
Gabon	4730.70	16638	36572	201759
Ghana	7930.90	12641	24300	227500
Greenland	38062.76	155025	260007	2268623
Liberia	6495.01	12687	18547	251781
Mauritania	5316.39	12321	36256	173180
Mexico	29820.90	235510	418736	3187013
Mozambique	15761.93	56141	85276	566292
Nigeria	10416.87	20315	216325	179048
Norway	56269.00	56269	155000	933027
Peru	21718.55	52059	88555	854698
Senegal	5352.22	10575	23893	158358
Seychelles	45268.00	45268	54833	1341504
Sierra Leone	8320.53	11116	26611	160584
Sri Lanka	52229.03	31342	32074	533559
Thailand	14162.37	50664	238380	298683
Territorial Sea	As defined by the 1982 United Nations Convention on the Law of the Sea, territorial sea is a belt of coastal water extending at most 12 nautical miles from the baseline (the low-water mark) of a coastal state			
Continental Shelf	As defined by the 1982 United Nations Convention on the Law of the Sea, the continental shelf of a coastal State comprises the seabed and subsoil of the submarine areas that extend beyond its territorial sea throughout the natural prolongation of its land territory to the outer edge of the continental margin or to the distance of 200 nautical miles from the baselines from which the breadth of its territorial sea is measured where the outer edge of the continental margin does not extend up to that distance.			
 Economic Exclusive Zone	As defined by the 1982 United Nations Convention on the Law of the Sea, EEZ is the area which a sovereign state has special rights regarding the exploration and use of marine resources, including energy production from water and wind			

- Population under 5m: This percentage describes the population lived in area where elevation is below 5m in total population, in 2010
- GINI Index: GINI index shows the economic inequality in the country. Higher index (closer to 100) shows relative unequal distribution of income in the country, whereas low index (closer to 0) shows relative equal distribution of income in the country, in 2018
- MPA: MPA means "Marine Protected Area", this percentage describes the area of marine protected area in territorial sea, in 2018
- Marine captures: Marine captures describe the marine fishery captures (in tons) of the country, in 2018

Table 3: Relevant Percentage for Legalized Marine Regions and Exclusive Small-scale Fishing Zone*

Country	Exclusive SSF Area			Comparison			
	% of Territorial Sea	% of Continental Shelf	% of EEZ	Population under 5m	GINI Index	MPA	Marine Captures
Bangladesh	100.00%	50.01%	29.23%	8.91%	32.4	5.36%	654687
Cambodia	84.45%	50.01%	29.23%	7.19%	36	0.18%	153600
Chile	45.10%	8.13%	2.47%	0.37%	44.4	12.60%	2369456
China	100.00%	13.90%	14.84%	6.55%	38.5	3.77%	12866871.6
Gabon	28.43%	12.94%	2.34%	4.94%	38	0.97%	18000
Ghana	62.74%	32.64%	3.49%	2.62%	43.5	0.93%	286767
Greenland	24.55%	14.64%	1.68%	46.46%	N/A	4.52%	301052
Liberia	51.19%	35.02%	2.58%	6.38%	35.3	0.10%	13810
Mauritania	43.15%	14.66%	3.07%	19.12%	32.6	4.15%	952706.752
Mexico	12.66%	7.12%	0.94%	1.58%	46.3	2.25%	1475665.203
Mozambique	28.08%	18.48%	2.78%	5.24%	54	2.23%	231256
Nigeria	51.28%	4.82%	5.82%	2.67%	43	0.02%	485967
Norway	100.00%	36.30%	6.03%	3.85%	27.5	0.83%	2658079
Peru	41.72%	4.82%	5.82%	0.92%	43.6	0.48%	7188944.468
Senegal	50.61%	22.40%	3.38%	10.06%	40.3	1.10%	452747
Seychelles	100.00%	82.56%	3.37%	16.64%	46.8	0.04%	145614
Sierra Leone	74.85%	31.27%	5.18%	3.79%	35.7	0.54%	200000
Sri Lanka	100.00%	100.00%	9.79%	2.98%	39.8	0.07%	422847
Thailand	27.95%	5.94%	4.74%	10.34%	36.9	1.88%	1510936
Population Live Under 5m	This percentage describes the population lived in area where elevation is below 5m in total population, in 2010						
GINI Index	GINI index shows the economic inequality in the country. Higher index (closer to 100) shows relative unequal distribution of income in the country, whereas low index (closer to 0) shows relative equal distribution of income in the country, in 2018						
MPA	MPA means "Marine Protected Area" , this percentage describes the area of marine protected area in territorial sea, in 2018						
Marine Captures	Marine captures describe the marine fishery captures (in tons) of the country, in 2018						

*: Population live under 5m (2010), GINI Index (2018), MPA Percentage (2018) come from World Bank open data, Marine captures (2018) comes from FAO.

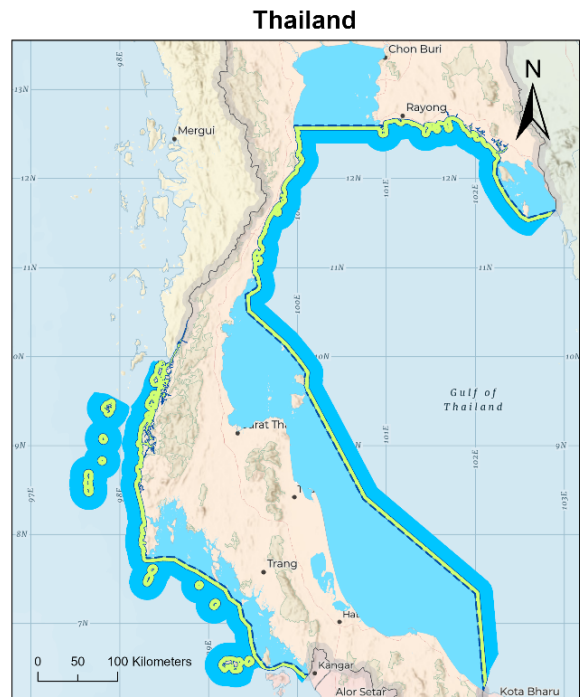
Maps

Map Category 1: Countries designate certain nautical miles from the coastline/baseline

Gabon and Thailand (3 nautical miles)



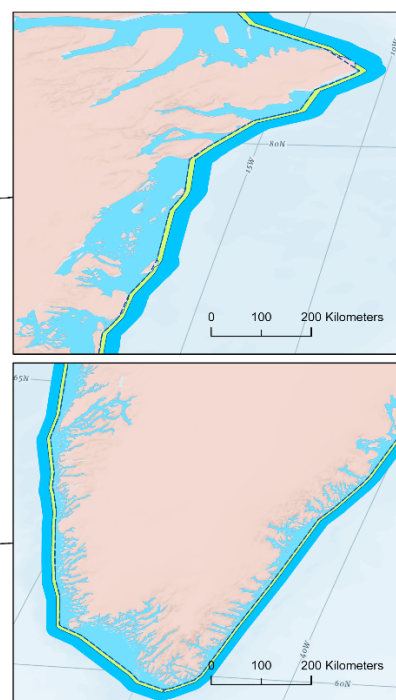
NOSTRA, Esri, HERE, Garmin, FAO, NOAA, USGS, Sources: Esri, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community, Esri, HERE, Garmin, FAO, NOAA, USGS



Map Coordinate System: WGS1984

- Straight Baseline
- Exclusive Small-scale Fishing Zone
- Internal Water
- Territorial Sea

Greenland (3 nautical miles)



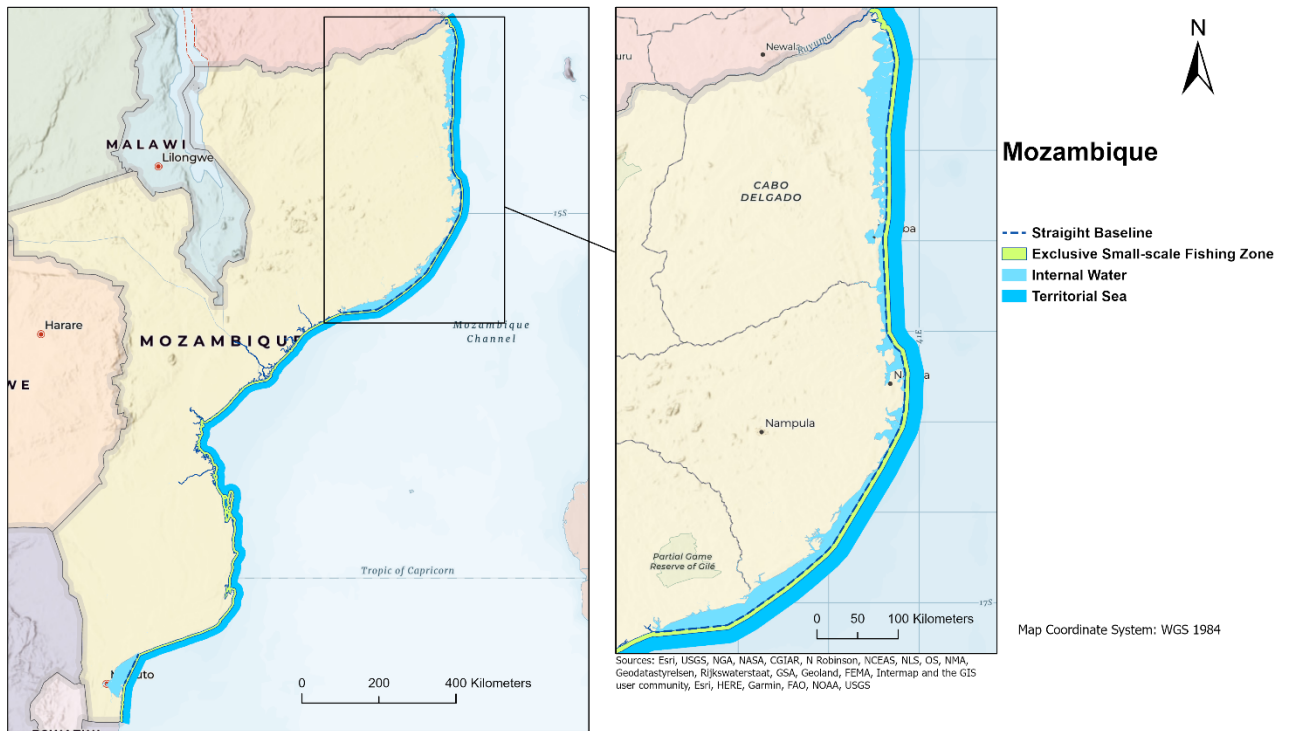
Greenland

- Straight Baseline
- Exclusive Small-scale Fishing Zone
- Internal Water
- Territorial Sea

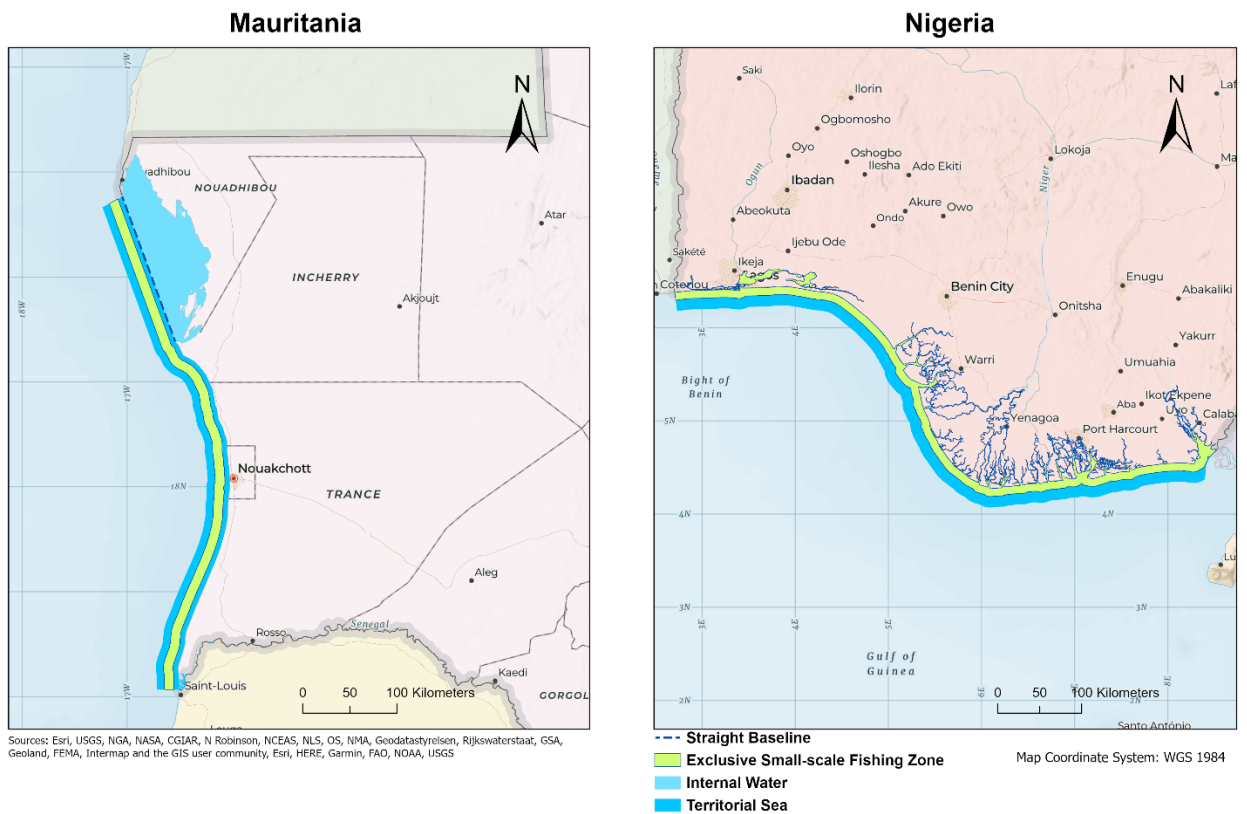
Map Projection: WGS1984 Winkel Triple (with 20 degree central meridian)

Sources: Esri, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community, Esri, HERE, Garmin, FAO, NOAA, USGS

Mozambique (3 nautical miles)



Mauritania (3 up to 9 miles) and Nigeria (5 nautical miles)



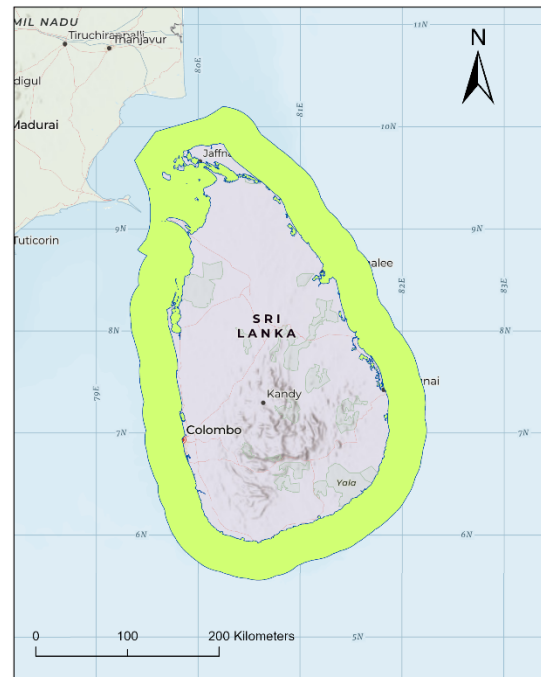
Peru (5 nautical miles) and Sri Lanka (40 km)

Peru



Sources: Esri, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community, Esri, HERE, Garmin, FAO, NOAA, USGS

Sri Lanka



Map Coordinate System: WGS 1984

- Straight Baseline
- Exclusive Small-scale Fishing Zone
- Internal Water
- Territorial Sea

Chile (5 nautical miles)



Chile

- Straight Baseline
- Exclusive Small-scale Fishing Zone
- Internal Water
- Territorial Water

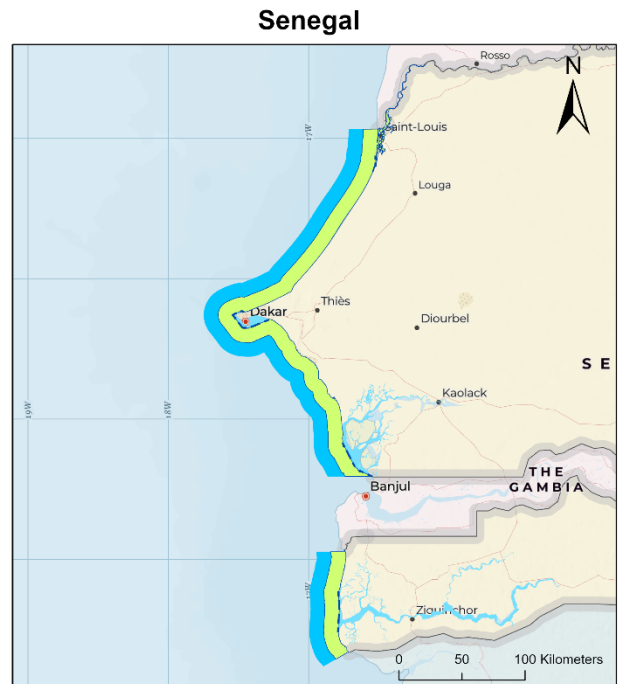
Map Coordinate System: WGS 1984

Esri, Garmin, FAO, NOAA, Sources: Esri, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community, Esri, HERE, Garmin, FAO, NOAA, USGS

Liberia and Senegal (6 nautical miles)



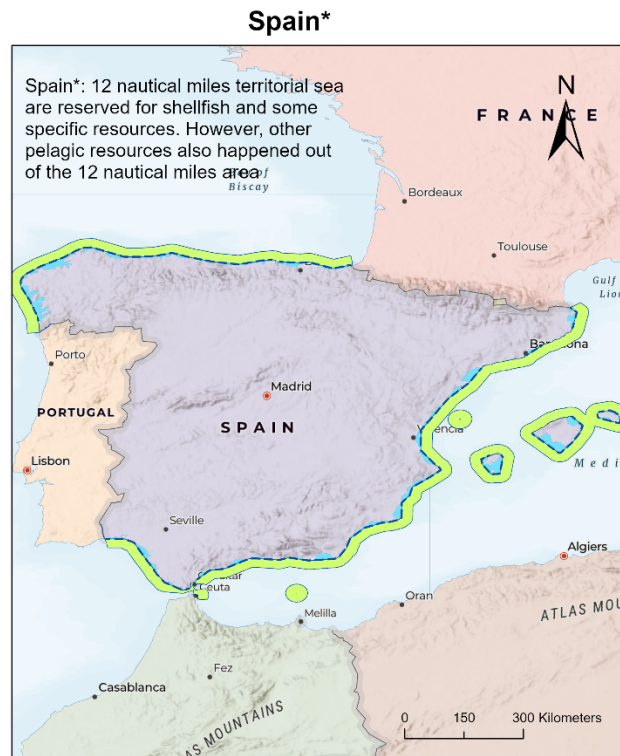
Esri, © OpenStreetMap contributors, HERE, Garmin, FAO, NOAA, USGS, Sources: Esri, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatasystemen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community, Esri, HERE, Garmin, FAO, NOAA, USGS



Map Coordinate System: WGS 1984

- Straight Baseline
- Exclusive Small-scale Fishing Zone
- Internal Water
- Territorial Sea

Spain and Norway (12 nautical miles)



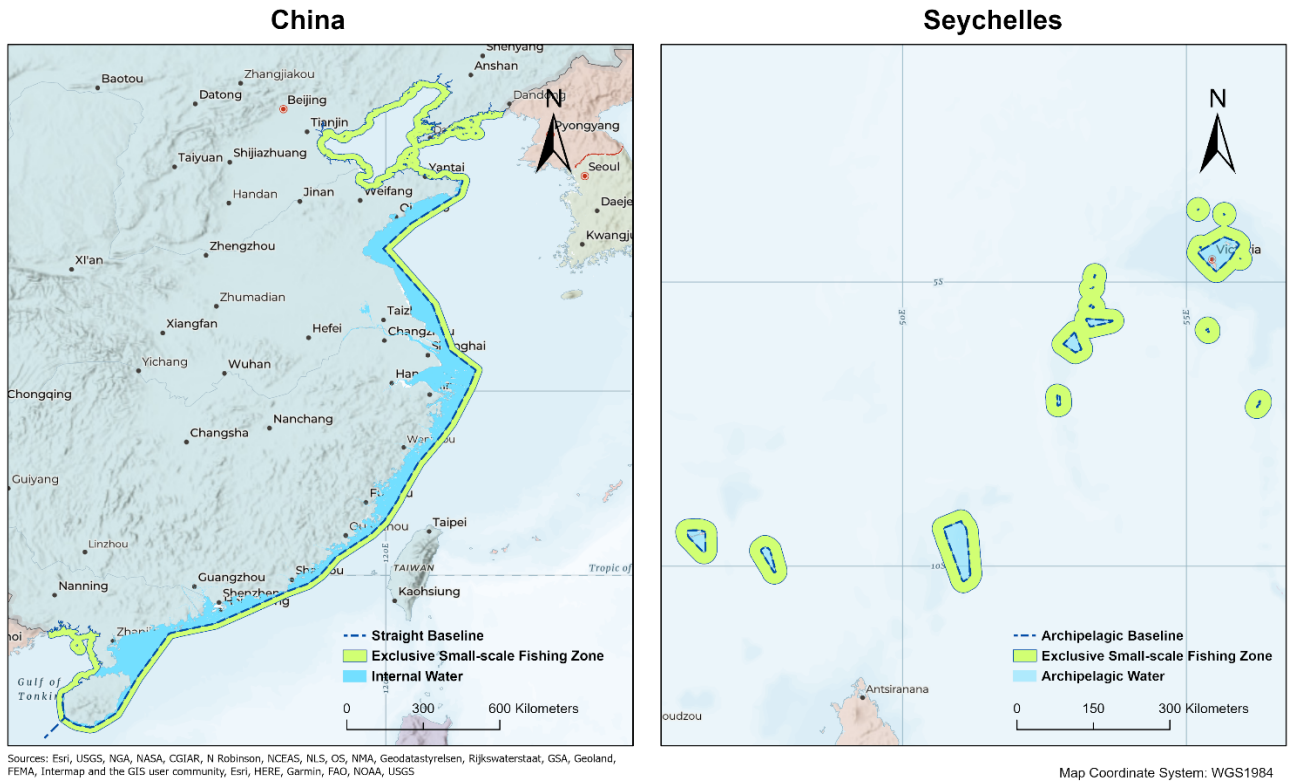
Esri, Garmin, FAO, NOAA, Sources: Esri, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatasystemen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community, Esri, HERE, Garmin, FAO, NOAA, USGS



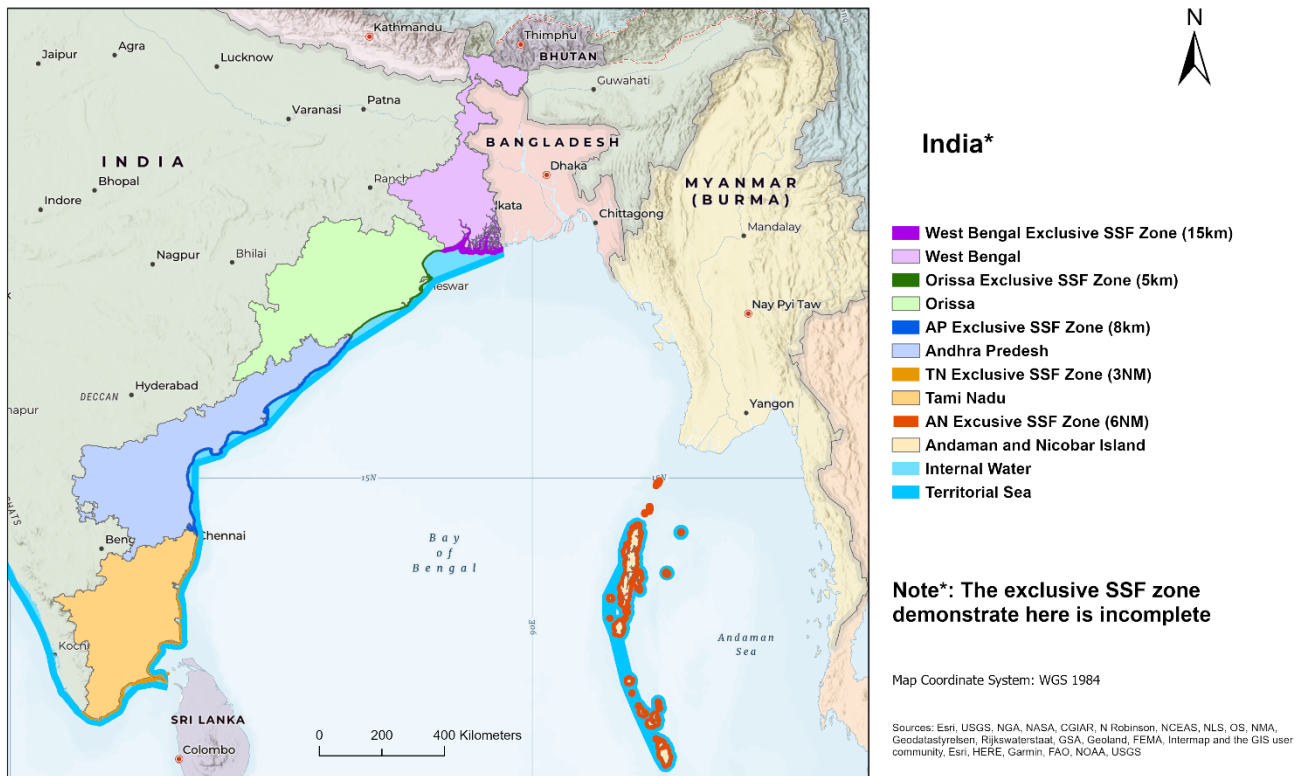
Map Coordinate System: WGS1984

- Straight Baseline
- Exclusive Small-scale Fishing Zone
- Internal Water

China and Seychelles (12 nautical miles)



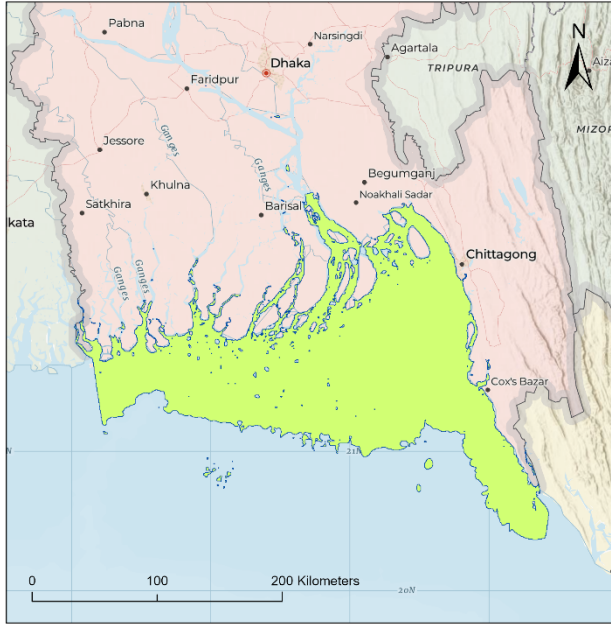
India*



*India has non-uniform exclusive small-scale fishery area reserved for each coastal state

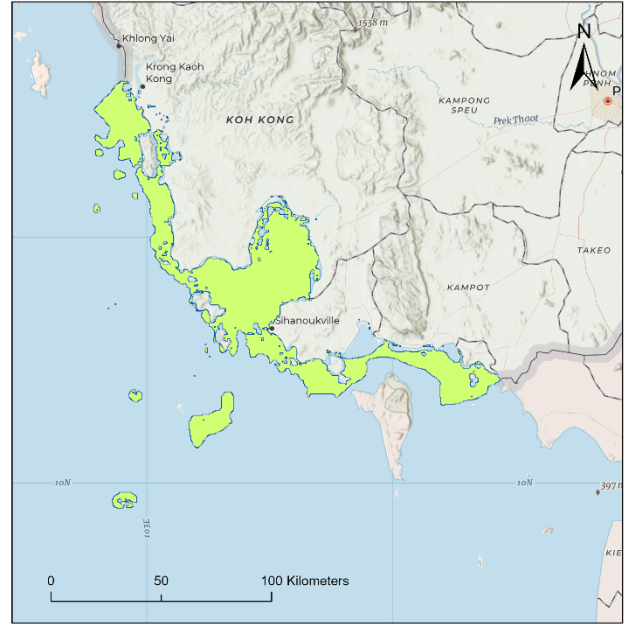
Map Category 2: Countries designate certain bathymetric depth
Bangladesh (40m) and Cambodia (20m)

Bangladesh



NOSTRA, Esri, HERE, Garmin, FAO, NOAA, USGS, Sources: Esri, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodataslydselen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community, Esri, HERE, Garmin, FAO, NOAA, USGS

Cambodia

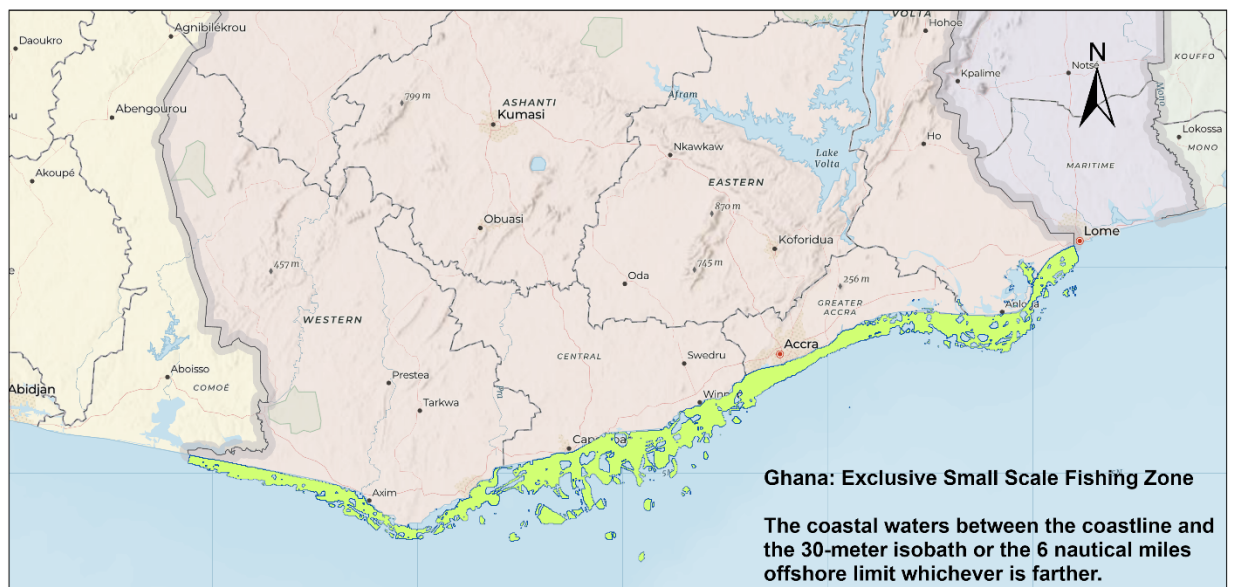


Exclusive Small-scale Fishing Zone

Map Coordinate System: WGS 1984

Ghana (30m depth or 6 nautical miles offshore whichever is farther)

Ghana



Ghana: Exclusive Small Scale Fishing Zone

The coastal waters between the coastline and the 30-meter isobath or the 6 nautical miles offshore limit whichever is farther.

Sources: Esri, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodataslydselen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community, Spatial Solutions & Services, Esri, HERE, Garmin, FAO, NOAA, USGS

Exclusive Small-scale Fishing Zone

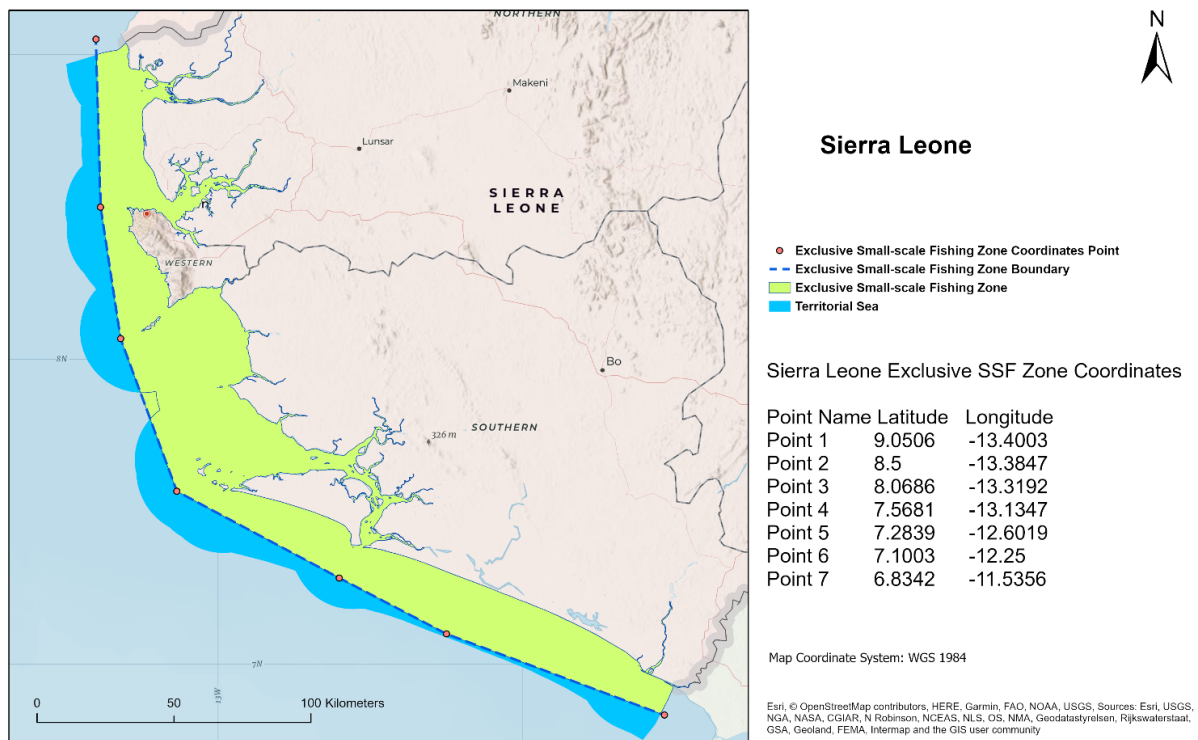
Map Coordinate System: WGS 1984

Mexico (5 fathom depth, about 9 meters)



Special Category: Country uses geographic coordinate description

Sierra Leone



Discussion

There are several interesting findings based on the relative percentage of exclusive small-scale fishery area demonstrated in table 3. First, there are five countries (Bangladesh, China, Norway, Seychelles and Sri Lanka) that reserve their entire territorial waters for small-scale fishery, which may demonstrate that those countries put specifically high emphasis on small-scale fishing industry in their marine fishery sector (Table 3). Among those countries, Bangladesh, China, Norway are ranked in top 10 countries in marine captures (tons), Sri Lanka is ranked in 11, whereas Seychelles have relatively low marine captures in compared to the rest four countries (Table 3). This result approves that marine fishing industry are relatively important for the five countries listed above, and small-scale fishery should play an important role in contributing to the marine captures of those countries. Second, the continental shelf is an important marine region for a country, as it not only includes the abundant biotic resources, but also has valuable abiotic sources like minerals, oils and gas. The shallow water depth in the continental shelf region makes it relatively easier for the exploration of natural resources. However, three countries listed above (Bangladesh, Seychelles, and Sri Lanka) have above 50% exclusive small-scale fishery area occupied in this region (Table 3). This result could imply that in comparison to the exploration of abiotic sources, those countries put higher emphasis on the exploration of biotic sources, which could indicate that biotic sources are relatively important for the economic values of the country. However, with the country development, the conflicts between the exploration of abiotic and biotic resources could be intensified into the future.

The percentage for population that lived under 5 meters is also an interesting factor to explore. Population lived in low elevation are relatively closer to the coastlines and thus are more likely to engage in small-scale fishing activities in comparison to the population lived at high elevations. It is interesting to mention that Greenland has almost 50% populations lived under 5 meters according to the result (Table 3). However, as Greenland has relatively low population (about 50000) compared to other countries in this study, it does not have the corresponding high marine captures as expected. Countries like Thailand, Mauritania, and Senegal have both relatively high percentage of populations (>10%) lived under low elevations, and high marine captures (Table 3). Some countries, like Seychelles, also has high percentage population lived under 5 meters (16.64%) but does not have high marine captures in compared to other countries listed above (Table 3). It is understandable as Seychelles is an archipelagic island country, thus it will naturally have many people lived in low elevations. Furthermore, if the country really relies heavily on small-scale fishery, then it is understandable that the marine captures of the country cannot compare to the countries that also rely on the large-scale commercial fishing.

Gini index is an economic index shows the income inequality of the countries. High index (closer to 100) shows the relative inequal distributions of income in the country, whereas low index (closer to 0) shows the relative equal distributions of income. Although the poor countries usually have a Gini index that varies in a large range, wealthy countries usually have Gini index below 40. According to Table 3, for the top 10 countries that have high marine captures, Peru, Chile, Mexico, Nigeria and Senegal have Gini index above 40. Except Norway, all other countries in top 10 marine captures have Gini index above 30. The relatively high Gini

index demonstrate in those countries indicate that the wealth distribution is relatively unequal in those countries. As small-scale fishermen are usually the low-income populations in a country, they should deserve more attentions when considering the fishing management policies, as both the conservation of biotic resources and economic development is important for this community, especially for the countries that rely heavily on fishing industry.

The marine protected area percentage (in territorial sea) is overall lower than the exclusive small-scale fishery area percentage (in territorial sea) for all countries listed in table 3. However, there are 5 countries that should deserve special attentions. They are Bangladesh, China, Cambodia, Seychelles and Sri Lanka (table 3). All of them have relative high percentage differences between MPA and exclusive SSF area (>80%). They are all countries that put high emphasis for small-scale fishery, especially for Bangladesh, Seychelles and Sri Lanka. However, MPA are important regions that used by countries to ensure the sustainable fishery development and conserve valuable biotic resources. Therefore, the large differences between their small-scale fishery area and MPA could lead to unsustainable fishery development in the future, which could result in severe consequences for the marine fishing industry of the country. Thus, those countries need to modify their fishery regulations and start to actively protect their biotic marine resources.

This spatial analysis also reveals a severe problem underlying the country's definition of exclusive small-scale fishing zone. Generally, countries have designated either certain nautical miles from marine baseline (represents the lower-water mark) or water area have certain bathymetric depth as the exclusive small-scale fishing zone. Based on the map result, it is clear that countries designate certain nautical miles from marine baseline usually have a uniform and clear exclusive small-scale fishing area marked from the coast. On the contrary, countries that use bathymetric depth have more scattered and unclear regions that can be used for small-scale fishery, which severely increase the difficulty in fishery management. Take Mexico as an example, the two inserted small maps show two different regions in Mexico. The first one is around California coast, while the second one is around Yucatan peninsula. From the first inserted map, it is obvious that the small-scale fishing areas are relatively scattered and separated from each other, whereas in second inserted map, the small-scale fishing areas are more clustered instead. It is clear that for fishermen lived in the first region, they will experience a harder time to locate and identify where they can fish and where they cannot, and for officials who regulate fishery, they will also have a harder time to control the fishermen to fish only in the area that belong to them. Not only for Mexico, for Bangladesh, Cambodia and Ghana, they all have small and far-away distributed regions that can be used for small-scale fishery which separated from the major fishing area. Not to mention that it is almost impossible for small-scale fishing vessels to travel that far, but also those scattered and far-away regions will cause confusion to small-scale fishermen to identify the area that they can fish, and thus increase the likelihood of conflicts between small-scale fishing and commercial fishing. Therefore, considering the relative ambiguous and volatile nature of the bathymetric depth as small-scale fishing zone, it is better for those countries to have a clearer geographic definition for their exclusive small-scale fishing zone. Furthermore, it would be better for the countries that have complex and ambiguous small-scale fishing zone standards to produce their own official maps, which could be very useful in helping the artisanal fishermen to identify the area where they can fish, and for officials to regulate the small-scale fishing

activities in their country.