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CWP ad-hoc Task Group on Geospatial (TG-Geospatial) Water Jurisdiction Areas standard developments

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Executive Summary

The present report details the developments pursued on designing and implementing on Water Jurisdiction Areas (WJA), as continuity with the work presented at CWP 27. It includes some background on the sensitive topic of the UN Convention on the Law of the Sea (UNCLOS) recalling the geographic definitions of the main UNCLOS area types, such as the Exclusive Economic Zone, often misused as proxy of the whole national water jurisdiction areas. The work builds on the distinction between National Jurisdiction Areas (NJAs) and ABNJ and proposes several geospatial datasets to which various levels of breakdowns are applied. Together with the GIS proof-of-concept tested through these developments, the work suggests a consolidated WJA coding system based on the Uniform Resource Name (URN) standard as mechanism to establish semantic persistent identifiers. Issues and limitations associated with the GIS methodology are highlighted. General recommendations are listed to extend the technical work beyond CWP through collaboration with technical institutions (eg. VLIZ) and UN divisions (UN Geospatial, UN DOALOS) and related groups of experts on geospatial and marine domain.

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1. Rationale & background

Generally, there is a growing need to refer to water jurisdiction areas in fisheries information systems and knowledge base case studies, whatever it deals with areas beyond national jurisdiction (ABNJ) or under national jurisdiction, referred here as NJA (National Jurisdiction areas). The UN Convention of the Law of the Sea (UNCLOS)¹ details the typology of areas and their characteristics in terms of jurisdiction. This typology was reflected as part of the CWP Handbook general concepts – main water areas², and approved as maritime areas types terms and definitions by the 12th session of the FIRMS Steering Committee³.

Despite UNCLOS defines explicitly the geographic extent of each type of jurisdiction area, there is still a general confusion on the extent of the areas, such as the Exclusive Economic Zone, which is still wrongly considered as proxy of the national jurisdiction area, encompassing other types of areas such as the territorial seas (TS), contiguous zone (CZ), internal waters (IW) or archipelagic waters.

Over the years, the Marine Regions⁴ portal and its maritime boundaries database⁵ has aroused interest, being mostly the unique initiative compiling information on national jurisdiction areas (including on Exclusive Economic Zones) and maintain it over time. For these reasons, FAO has been collaborating with VLIZ, the Marine Regions leading institution, to improve usability of the Maritime database. While some consolidation has been carried out to extend the dataset with UN standards (eg. addition of the M49 coding system to characterize national jurisdiction areas), it was recognized from both parties that the initial goal of the Maritime boundaries database was not to provide data tightly aligned on the UNCLOS areas definitions, but to conduct biodiversity-oriented research studies. Hence, the concept of Exclusive Economic Zone, which is by essence a UNCLOS legal area definition, was altered considering:

- a larger geographic extent of the Exclusive Economic Zone definition (encompassing territorial seas and other types of areas adjacent to the baseline) as National Jurisdiction Area proxy.
- The assumption made that all NJAs (named in Marine Regions as EEZs) are Exclusive Economic Zones, even when the corresponding country members didn't formally define and recognized the extent of their Exclusive Economic Zone.

This approach, although valid for research purpose, becomes problematic when trying to use this dataset as standard in a geopolitical context such as UN where the principle of neutrality is a major concern; because of a misalignment of definitions of the actual UNCLOS area definitions, and a generalization of the concept of EEZ to all national jurisdiction areas drawn as part of this geospatial dataset. On the other hand, recent improvements and extensions of the Marine Regions database demonstrate a dynamic and strong interest in aligning concepts with UNCLOS with for example the effort to extend the database Extended Continental Shelf areas and adding a layer for high-seas / ABNJ.

¹ https://www.un.org/depts/los/convention_agreements/texts/unclos/unclos_e.pdf

² <https://www.fao.org/cwp-on-fishery-statistics/handbook/general-concepts/main-water-areas/en/>

³ <https://www.fao.org/3/cb8334en/cb8334en.pdf>

⁴ <https://www.marineregions.org>

⁵ <https://www.marineregions.org/eezsearch.php>

2. Scope & objectives

The present work, initiated as part of the former CWP ad hoc task group on Reference Harmonization 2 (CWP TG-RH2), aims to design a coding system for water jurisdiction areas, tightly coupled to the UNCLOS definitions, to reduce the sensitiveness of the data for case studies performed under a UN umbrella. Being the most exhaustive source available on the matter, the Marine Regions portal was logically identified as primary material. A first exercise referred as “*Towards a coding system for Water Jurisdiction Areas and Areas Beyond National Jurisdiction*” was conducted and presented at the CWP27⁶ to trigger discussions. It was then recommended by CWP27 to extend further this work as main term of reference for a dedicated CWP task group on Geospatial (TG-Geospatial) including a finalized coding system and a set of geospatial data layers that implement it.

3. Design and implementation

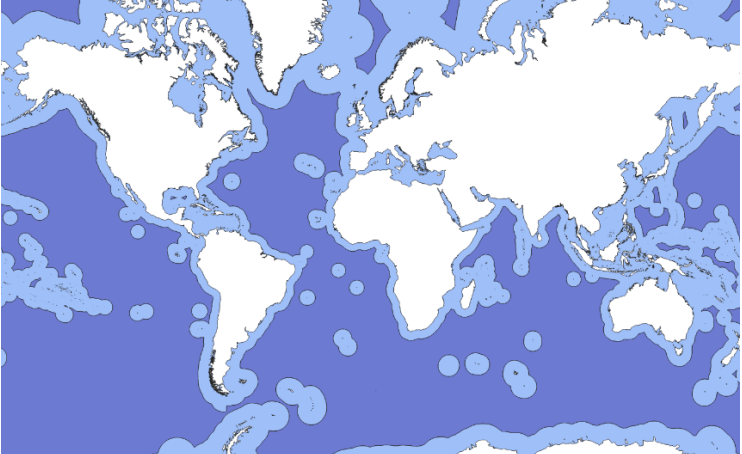
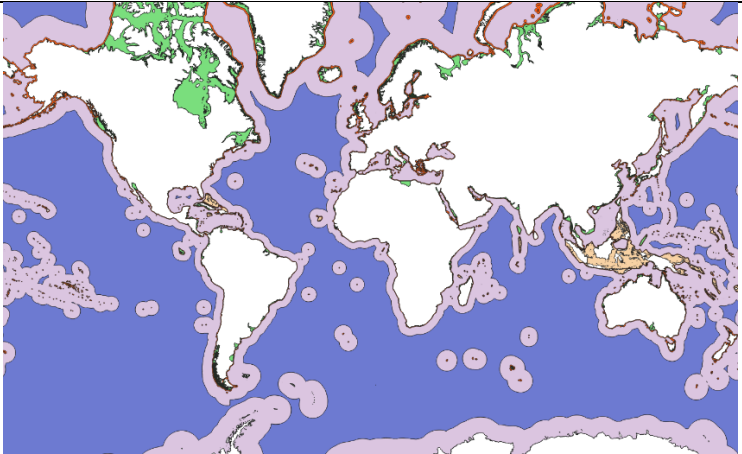
The envisaged standard on Water Jurisdiction areas encompasses two facets:

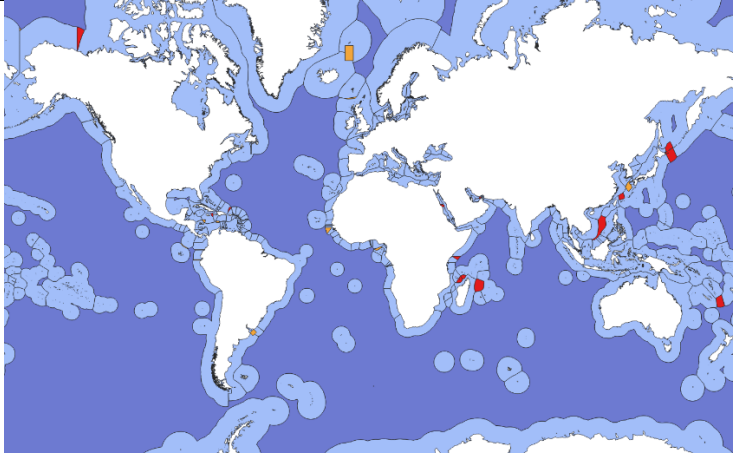
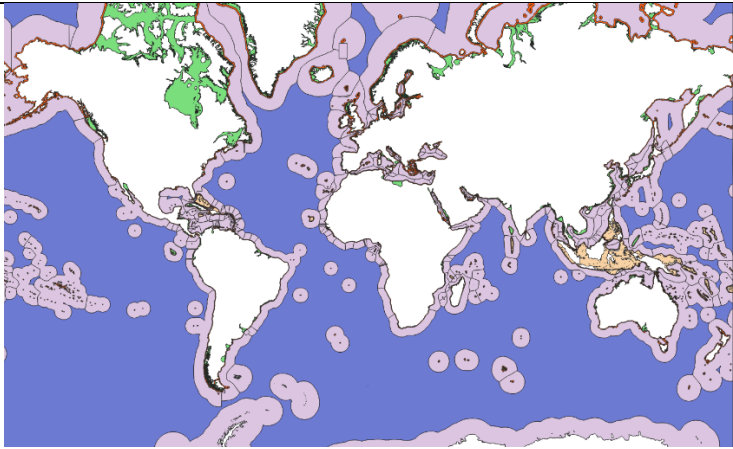
- The design and implementation of a GIS workflow with the production of reference geospatial datasets
- The design and implementation of an area coding system to identify geospatial areas.

⁶ <https://www.fao.org/3/cc0653en/cc0653en.pdf>

3.1. Candidate WJA datasets

Several levels of expected geospatial data products and underlying code lists have been listed in the table below:

Dataset	Description	Map preview
1a	global dataset giving the NJAs vs. ABNJ (resulting in 2 large polygons); as basis for other derivate products	 <p>A world map where landmasses are white and the oceans are a solid blue. The map shows the outlines of continents and major islands, representing the boundaries between National Jurisdiction Areas (NJAs) and Areas Beyond National Jurisdiction (ABNJ).</p>
1b	global dataset giving the NJAs vs. ABNJ with breakdown by UNCLOS main area types (EEZ, TS, IW, AW), without breakdown by national areas.	 <p>A world map showing a more detailed breakdown of maritime areas. Landmasses are white. The oceans are colored in various shades: light blue for EEZ, green for TS, purple for IW, and yellow for AW. The map shows the outlines of continents and major islands, representing the boundaries between National Jurisdiction Areas (NJAs) and Areas Beyond National Jurisdiction (ABNJ) with breakdown by UNCLOS main area types.</p>

2a	global dataset giving the NJAs vs. ABNJ (as defined in dataset 1a) with a breakdown by national areas;	 A world map showing National Jurisdiction Areas (NJAs) and Areas Beyond National Jurisdiction (ABNJ). The map uses various colors to delineate national areas: red for the Arctic region, orange for the North Atlantic, and blue for the Pacific and Indian Oceans. The ABNJ areas are shown in white.
2b	global dataset giving the NJAs vs. ABNJ with breakdowns by national areas and UNCLOS main area types	 A world map showing National Jurisdiction Areas (NJAs) and Areas Beyond National Jurisdiction (ABNJ) with breakdowns by national areas and UNCLOS main area types. The map uses various colors to delineate national areas: green for the Arctic region, purple for the North Atlantic, and blue for the Pacific and Indian Oceans. The ABNJ areas are shown in white.

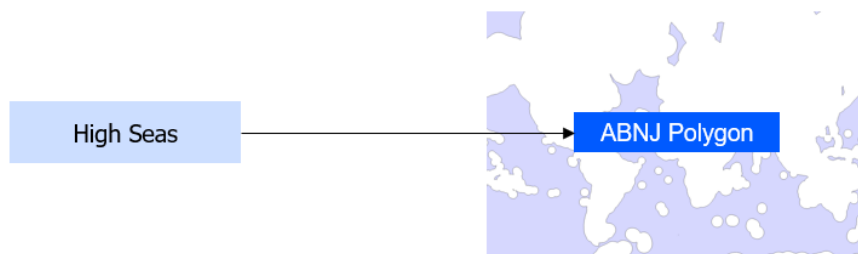
3.2. GIS workflow

A GIS workflow was designed taking as inputs data layers accessed from the Marine Regions portal and its spatial data infrastructure⁷. As proof-of-concept, and in a first stage, the workflow is implemented with semi-automatic processes using QGIS GIS desktop software.

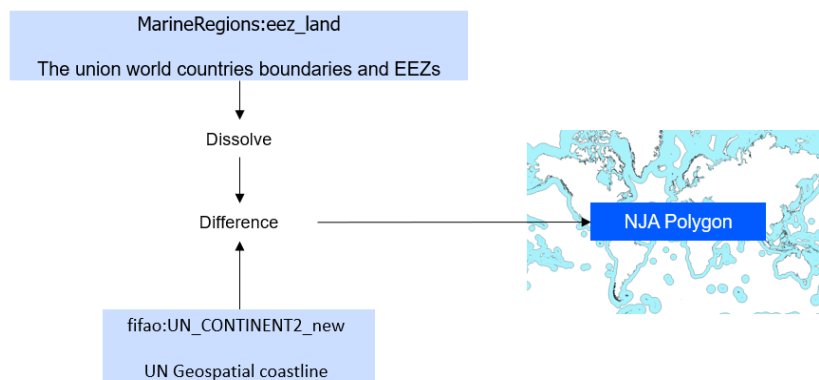
Base shapefiles used to derivate water Jurisdiction areas were accessed from Marine Regions⁸ website. The coastline used is the one used by UN Geospatial and accessed through FAO Fisheries & aquaculture Geoserver⁹ ("fifao:UN_CONTINENT2_new" layer).

Dataset 1a

Area beyond national jurisdiction polygon is keeping the boundaries from the High Seas polygon taken from Marine Regions (Flanders Marine Institute (2020). Maritime Boundaries Geodatabase: High Seas, version 1. Available online at <https://www.marineregions.org/https://doi.org/10.14284/418>.)



National Jurisdiction Area polygon obtained by the difference between the UN Geospatial Coastline and the dissolved polygon of "the union world countries boundaries and EEZs" polygon from Marine Regions (Flanders Marine Institute (2020). Union of the ESRI Country shapefile and the Exclusive Economic Zones (version 3). Available online at <https://www.marineregions.org/https://doi.org/10.14284/403> . Consulted on 2023-06-06.).



Dataset 1b

The following process steps have been applied:

- Shapefile download:

⁷ <https://geo.vliz.be/geoserver>

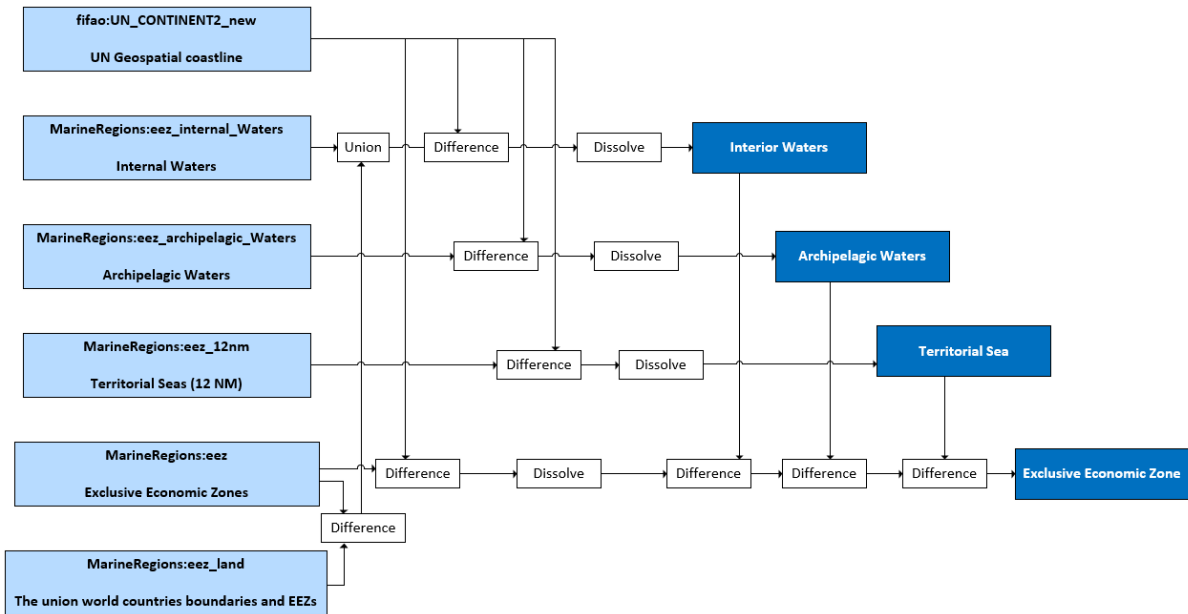
⁸ <https://www.marineregions.org/>

⁹ <https://www.fao.org/fishery/geoserver>

- "Internal Waters" layer from Marine Regions (Flanders Marine Institute (2019). Maritime Boundaries Geodatabase: Internal Waters, version 3. Available online at <https://www.marineregions.org/> <https://doi.org/10.14284/385>).
- "Archipelagic Waters" layer from Marine Regions (Flanders Marine Institute (2019). Maritime Boundaries Geodatabase: Archipelagic Waters, version 3. Available online at <https://www.marineregions.org/> <https://doi.org/10.14284/383>).
- "12 nautical miles zones (territorial seas)" layer from Marine Regions (Flanders Marine Institute (2019). Maritime Boundaries Geodatabase: Territorial Seas (12NM), version 3. Available online at <https://www.marineregions.org/> <https://doi.org/10.14284/387>).
- "Exclusive Economic Zones (200NM), version 11" layer from Marine Regions (Flanders Marine Institute (2019). Maritime Boundaries Geodatabase: Maritime Boundaries and Exclusive Economic Zones (200NM), version 11. Available online at <https://www.marineregions.org/> <https://doi.org/10.14284/386>).
- Marine Regions Coastline obtained by the difference between the layer "the union world countries boundaries and EEZs" and the layer "Exclusive Economic Zones (200NM), version 11" of Marine Regions.
- Union of the Marine Region Coastline and the "Internal Waters" shapefile from Marine Regions.
- Interior Waters (IW) definitive shapefile obtained by the difference of the Union of the Marine Region Coastline and the "Internal Waters" shapefile from Marine Regions with the UN Geospatial coastline. Final dissolve for obtaining the overall layer without national breakdown.
- Archipelagic Waters (AW) definitive shapefile obtained by the difference between the "Archipelagic Waters" shapefile from Marine Regions and the UN Geospatial coastline. Final dissolve for obtaining the overall layer without national breakdown.
- Territorial Sea (TS) definitive shapefile obtained by the difference between the "12 nautical miles zones (territorial seas)" shapefile Marine Regions and the UN Geospatial coastline. Final dissolve for obtaining the overall layer without national breakdown.
- Exclusive Economic Zone (EEZ) obtained by first dissolving Marine Regions shapefile "Exclusive Economic Zones (200NM), version 11" for obtaining the overall layer without national breakdown. Then, the EEZ definitive shapefile, obtained by the difference of the resulting polygon from Marine Regions shapefiles "Internal Waters", "Archipelagic Waters", "12 nautical miles zones (territorial seas)", and the UN Geospatial coastline.

Please note that, following this process, all the delta obtained from the difference between the Marine Regions coastline and the UN Geospatial coastline is absorbed in the Internal Waters final shapefile.

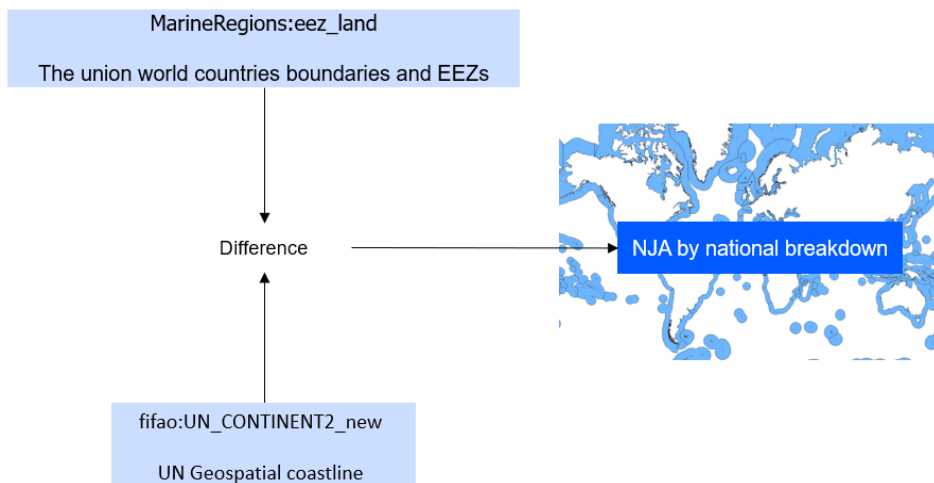
Schematic view:



Dataset 2a

Area beyond national jurisdiction polygon is the same one as for Dataset 1a.

National Jurisdiction Area polygons by national breakdown were obtained by the difference between the UN Geospatial coastline and the polygons of Marine Regions layer "the union world countries boundaries and EEZs" polygon from Marine Regions (Flanders Marine Institute (2020). Union of the ESRI Country shapefile and the Exclusive Economic Zones (version 3). Available online at <https://www.marineregions.org/> . <https://doi.org/10.14284/403> . Consulted on 2023-06-06.).



Dataset 2b

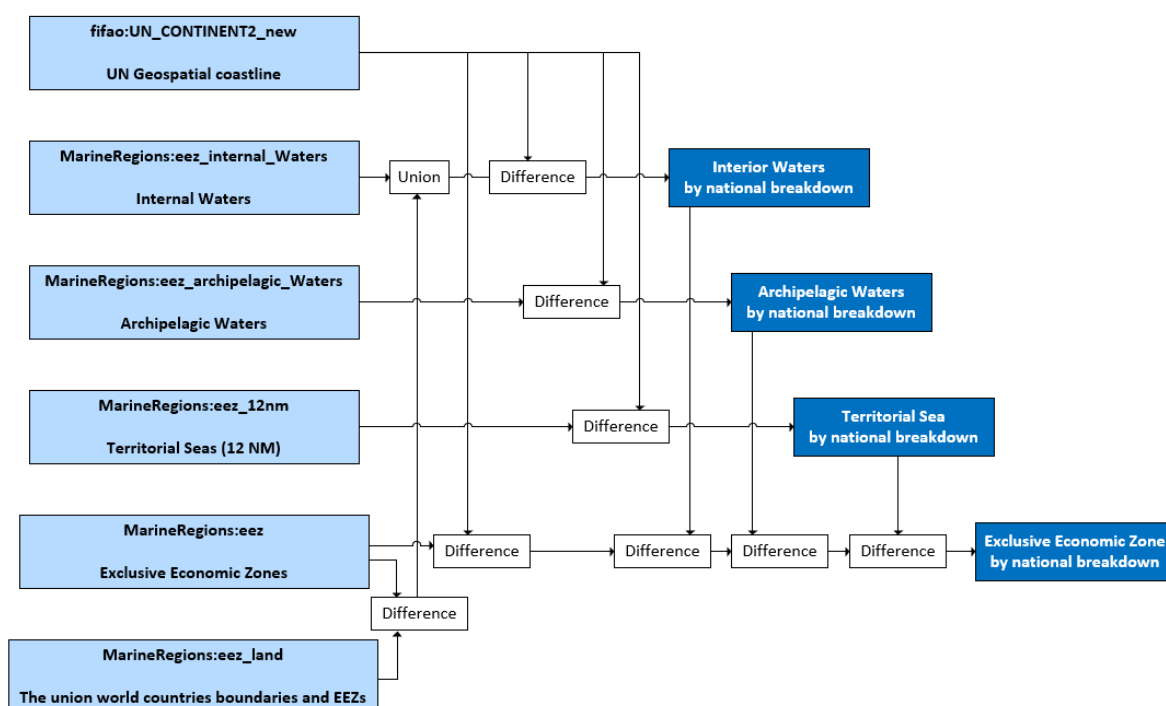
The following process steps have been applied:

- Shapefile downloads

- Download of "Internal Waters" layer from Marine Regions (Flanders Marine Institute (2019). Maritime Boundaries Geodatabase: Internal Waters, version 3. Available online at <https://www.marineregions.org/> <https://doi.org/10.14284/385>).
- Download of "Archipelagic Waters" layer from Marine Regions (Flanders Marine Institute (2019). Maritime Boundaries Geodatabase: Archipelagic Waters, version 3. Available online at <https://www.marineregions.org/> <https://doi.org/10.14284/383>).
- Download of "12 nautical miles zones (territorial seas)" layer from Marine Regions (Flanders Marine Institute (2019). Maritime Boundaries Geodatabase: Territorial Seas (12NM), version 3. Available online at <https://www.marineregions.org/> <https://doi.org/10.14284/387>).
- Download of "Exclusive Economic Zones (200NM), version 11" layer from Marine Regions (Flanders Marine Institute (2019). Maritime Boundaries Geodatabase: Maritime Boundaries and Exclusive Economic Zones (200NM), version 11. Available online at <https://www.marineregions.org/> <https://doi.org/10.14284/386>).
- Marine Regions Coastline obtained by the difference between the layer "the union world countries boundaries and EEZs" and the layer "Exclusive Economic Zones (200NM), version 11" of Marine Regions.
- Union of the Marine Region Coastline and the "Internal Waters" shapefile from Marine Regions.
- Interior Waters (IW) definitive shapefile obtained by the difference of the Union of the Marine Region Coastline and the "Internal Waters" shapefile from Marine Regions with the UN Geospatial coastline.
- Archipelagic Waters (AW) definitive shapefile obtained by the difference between the "Archipelagic Waters" shapefile from Marine Regions and the UN Geospatial coastline.
- Territorial Sea (TS) definitive shapefile obtained by the difference between the "12 nautical miles zones (territorial seas)" shapefile Marine Regions and the UN coastline.
- Exclusive Economic Zone (EEZ) definitive shapefile obtained by the difference of Marine Regions shapefile "Exclusive Economic Zones (200NM), version 11" from Marine Regions shapefiles "Internal Waters", "Archipelagic Waters", "12 nautical miles zones (territorial seas)", and the UN Geospatial coastline.

Please note that, following this process, all the delta obtained from the difference between the Marine Regions coastline and the UN Geospatial coastline is absorbed in the Internal Waters final shapefile.

Schematic view:



3.3. Coding system

As general information management best practice to design **globally unique persistent identifiers**, and as joint capacity building effort with the work performed in the CWP TG-RH to publish digital resources in support of CWP reference harmonization case studies, it was decided to try implementing a coding system aligned with the Unique Resource Name (URN) specification¹⁰. As joint effort with the CWP-RH and considering digital resources may not be always referring formally to CWP standards, but to candidate standards or ad hoc standards not part of CWP but identified as case studies cross-cutting needs; the URN chosen will refer to the ad hoc *fdi* namespace identifier (standing for *Fisheries Data Interoperability*) chosen for the CWP RH digital resources.

The below coding system proposal applies for both identification of datasets (as geospatial code lists) and its features (identified with area codes).

3.3.1. Dataset identifiers

The four main target datasets listed above can be distinguished depending on the nature of the geospatial features considered and the type of breakdown:

- *base* data: UNCLOS area types, which can be split into a basic set of information distinguishing into:

¹⁰ https://en.wikipedia.org/wiki/Uniform_Resource_Name

- categories (base 0): National Jurisdiction Areas (NJA), Areas Beyond National Jurisdiction Areas (ABNJ), extended eventually with a third category for Extended Continental Shelf (ECS)
- typologies (base 1): target the types of UNCLOS areas encompassed by an NJA
- *leveled* data combining the base data with breakdown by national boundaries
 - breakdown by main categories (level 0)
 - breakdown by categories + typologies (level 1)

Proposal of dataset identifiers (URNs):

Overall scheme:

urn:fdi:<resourceType>:<authority>:<resourceCode>:<type [base|level]>

with:

<resourceType> = codelist (dataset)

<authority> = cwp

<resourceCode> = wja

	URN	Breadown by UNCLOS type	Breakdown by national boundary
1a	urn:fdi:codelist:cwp:wja:base0		
1b	urn:fdi:codelist:cwp:wja:base1	X	
2a	urn:fdi:codelist:cwp:wja:level0		X
2b	urn:fdi:codelist:cwp:wja:level1	X	X

Note: The proposal of using the term “level” specifically for the breakdown by national boundaries was made based on the analogy with administrative (land-based) unit databases such as the FAO Global Administrative Unit Layer (GAUL) which sets various levels of units, with the level 0 being the national / country level.

3.3.2.Features/Areas identifiers

The below URN methodology suggests how to assign a persistent identifier to each WJA feature/area polygon:

3.3.2.1. General identification mechanism

For dataset 1a – *urn:fdi:codelist:cwp:wja:base0*, the overall scheme is as follows:

urn:fdi:<resourceType>:<authority>:<resourceCode>:<category>

with:

<resourceType> = code

<authority> = cwp

<resourceCode> = wja

<category> = abnj | nja | ecs

We can distinguish 2 main identifiers to cover NJA and ABNJ multipolygon features:

- All ABNJs: urn:fdi:code:cwp:wja:abnj
- All NJAs: urn:fdi:code:cwp:wja:nja

For dataset 1b – *urn:fdi:codelist:cwp:wja:base1*, which adds a breakdown by UNCLOS area type, the UNCLOS area type can be added for the NJA category, extending the overall scheme:

urn:fdi:<resourceType>:<authority>:<resourceCode>:<category>:<areaType>

with:

<resourceType> = code
 <authority> = cwp
 <resourceCode> = wja
 <category> = abnj | nja | ecs
 <areaType> = eez | ts | iw | aw

We can then distinguish the following identifiers (in addition to those listed above for ABNJ and ECS in case these features are kept in the dataset):

- urn:fdi:code:cwp:wja:nja:eez
- urn:fdi:code:cwp:wja:nja:ts
- urn:fdi:code:cwp:wja:nja:iw
- urn:fdi:code:cwp:wja:nja:aw
- urn:fdi:code:cwp:wja:abnj
- urn:fdi:code:cwp:wja:ecs

For dataset 2a – *urn:fdi:codelist:cwp:wja:level0*, which adds a breakdown by national boundaries over dataset 1a, the overall scheme would be as follow:

urn:fdi:<resourceType>:<authority>:<resourceCode>:<category>:iso:<isocode>

with:

<resourceType> = code
 <authority> = cwp
 <resourceCode> = wja
 <category> = abnj | nja | ecs
 <isocode> = country/territory ISO3 code

Examples:

- Trinidad & Tobago NJA: urn:fdi:code:cwp:wja:nja:iso:tto
- Martinique NJA: urn:fdi:code:cwp:wja:nja:iso:mtq

For dataset 2b – *urn:fdi:codelist:cwp:wja:level1*, which adds a breakdown by national boundaries and by UNCLOS area type, the overall scheme would be as follow:

urn:fdi:<resourceType>:<authority>:<resourceCode>:<category>:<areaType>:iso:<isocode>

with:

<resourceType> = code
 <authority> = cwp

<resourceCode> = wja
 <category> = abnj | nja | ecs
 <areaType>= eez | ts | iw | aw
 <isocode> = country/territory ISO3 code

Examples:

- Trinidad & Tobago TS: urn:fdi:code:cwp:wja:nja:ts:iso:tto
- Trinidad & Tobago EEZ: urn:fdi:code:cwp:wja:nja:eez:iso:tto

3.3.2.2. Exceptions

They are areas for which jurisdiction is either unknown or not established (eg. due to overlapping claims), in a hybrid form (eg. joint regimes between nations) or with extended exploitation rights (eg. Extended Continental shelf areas). For these cases, specific codings may be used as precautionary approach:

- Joint regimes areas: urn:fdi:code:cwp:wja:jra
- Overlapping claim areas : urn:fdi:code:cwp:wja:oca
- Extended continent shelf: urn:fdi:code:cwp:wja:ecs

As basis these features could be added as part of the dataset 1a (urn:fdi:codelist:cwp:wja:base0).

3.3.2.3. Features requiring special attention

Different areas under joint regimes and overlapping claims are identified by the Marine Regions database (See <https://www.marineregions.org/eezmapper.php>).

Some jurisdiction areas were not explicitly identified by Marine Regions as Overlapping Claims. These regions need further legal advice for identification.

Examples of these areas are:

- Taiwan Province of China's waters
- Palestine waters

3.4. Issues and limitations

On the GIS workflow

- Various GIS limitations were faced in the design of the geospatial standard on Water Jurisdiction Areas due to the misalignment of coastline resolutions between the one used in Marine Regions versus the one used as reference in UN Geospatial data layers. Indeed the coastline resolution has a direct impact on the delineation of the *baseline* which is the reference boundary to derive the different UNCLOS area types:
 - It is possible to derive data layers without breakdown by UNCLOS type, ie making only the distinction between NJA and ABNJ, as the NJA encompasses all UNCLOS area types beyond the *baseline* (EEZ, CZ, TS) and between the *baseline* and the

coastline (IW, AW). Since the *baseline* is a derivative product from the *coastline*, some bias is introduced but the outer boundaries of the NJA can be produced without any geo-processing issue.

- The breakdown by UNCLOS area types is possible for types defined beyond the *baseline* (EEZ, CZ, TS) with the same bias.
- Breakdown by UNCLOS area types between the *baseline* and the coastline are not processable, due to the presence of overlap artefact between the coastline adopted by UN Geospatial and the *baseline*, that is derived from another coastline resolution.
- The information available on Marine Regions on the Extended Continental Shelf (ECS) has not yet been processed, due to the lack of knowledge of each ECS area with respect to its processing status through the Commission on the Limits of the Continental Shelf (CLCS)

On the coding system

The coding system applied to the breakdown by nations is by definition limited to this scope. Although it may be applicable to ECS, it is not for other exceptions, such as areas under joint regime and overlapping claim areas. For these, it is recommended not to try entering into coding details and to refer to generic codes associated to these area types. Perspectives / Future developments

1. At short-term, it is envisaged to reproduce the GIS workflow (at least for datasets base0 and level0) and the coding system build through a programmatic automatic approach (using R language). The workflow should include the publication of draft geospatial datasets in the FAO NFI Geonetwork platform for geospatial datasets, and the ad hoc CWP registry of digital resources at <https://github.com/fdiwg/fdi-codelists>
2. Extend the coding methodology to derivative GIS products beyond the Water Jurisdiction Areas definition, by conducting intersection processes as proofs-of-concepts (eg. intersection WJA vs. FAO Major area).
3. Draft a collaboration proposal with VLIZ based on current issues / limitations faced by CWP during the exercise, including:
 - a. Difficulties to align with UN Geospatial coastline resolution
 - b. Need to reproduce the baseline processing based on above alternate coastline resolution to remove biases in NJA outer boundaries definitions and resolve geospatial artefacts/issues for UNCLOS area types adjacent to the baseline (territorial seas, internal waters, archipelagic waters)
 - c. Discuss how to process information on Extended Continental Shelf areas with respect to their processing status through the Commission on the Limits of the Continental Shelf (CLCS)
4. Seek for opportunities to discuss the present work with UN divisions (such as UN Geospatial, UN DOALOS) and related working groups to get feedback.