Food and Agriculture Organization of the United Nations

COORDINATING WORKING PARTY ON FISHERY STATISTICS

Sixth Meeting of the Aquaculture Subject Group (AS) and
Twenty-seventh meeting of the Fisheries Subject Group (FS)

GIS TECHNICAL WORKING GROUP FOR THE CWP HANDBOOK

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GIS SECTIONS PROPOSAL

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Title	Definition / Scope	Target
Spatial reference systems	Standards to use for handling a spatial reference system (SRS) used with fisheries dataset. Definitions; rationale; equivalent terminologies; recommended standard format & notations; use of Spatial Reference Identifiers (SRIDs); SRS use cases	CWP Handbook GIS Section
Geographic coordinates	Standards for handling properly geographic coordinates for reference shapes and fisheries datasets. Definitions; rationale; recommended standard formats; Geographic coordinates use cases.	CWP Handbook GIS Section
Geographic classification and coding systems Water main areas	Geographic classification and coding systems used for fisheries data. General; Types of geographic classification systems (Irregular areas, grid reporting systems, Others); Main geographic classification systems (FAO Major Fishing areas, Breakdown of major fishing areas; Geographic coding systems;	CWP Handbook GIS Section
Geographic information formats & protocols	Standards format for data and metadata, and related standard protocols. Data formats and protocols; Metadata formats and protocols;	CWP Data sharing and protocols/ Geospatial Section
Geographic information resources of interest for CWP	Geographic information list of resources of interest for the CWP. Geographic information reference web-catalogues; GIS datasets of primary interest;	CWP Website

- **Handbook GIS Section proposal**
  - Title: Geographic Dimension
  - Structure

1. **Spatial reference systems**
2. **Geographic coordinates**
3. **Geographic systems**
4. **Country or areas**
5. **Main water areas**
   - **FAO Major Fishing Areas for Statistical Purpose**
   - **Areal Grid System**
   - **Water Jurisdictional Areas**

NEW

- **Spatial Reference Systems**
  - Geo-referenced statistical datasets require to be associated with the reference system used for geographic coordinates

    Spatial Reference System (SRS) ~ Coordinate Reference System (CRS)
  - SRS Identification
    - unique numerical Spatial Reference Identifier, abbreviated SRID, in association to a registry.
  - SRS Registries
    - Most common registry = EPSG in reference to the EPSG working group (European Petroleum Survey Group) that first established a *registry* of spatial reference systems worldwide.
    - Common to find "EPSG code " or "EPSG authority code": EPSG:**<SRID>**
    - Example: EPSG:4326 (World Geodetic System – WGS84)
    - Other registries: eg ESRI registry. Example: ESRI:54012 (*Eckert IV* projection used for area calculation).

NEW

- **Spatial Reference Systems**
  - Other standard SRS notation endorsed by the Open Geospatial Consortium (OGC):Unique Resource Name (URN) – **urn:x-ogc:def:crs:epsg::4326**
  - Large set of Spatial Reference Systems
  - SRS with different purposes:
    - **SRS for data production, exchange and dissemination:**

      Whatever the domain, geo-referenced datasets must be accompanied by the corresponding spatial reference system, specified by its EPSG code.

      Recommendation: Use of WGS84 (*EPSG:4326*)
    - **SRS for areal calculation**

      Necessary to switch to a SRS based on metric units (uniform unit around the world), designed to conserve area proportions around the world, namely an *equal areal* projection.

      Recommendation: Use Eckert IV (ESRI:54012), or any other defined equal area SRS
    - **SRS for visualization**

      Recommendations: Use of WGS84 (*EPSG:4326*) as default SRS, Equal Area SRS

      Mercator highly NOT recommended

Spatial Reference Systems - Sources

- **ESRI Registry:** http://spatialreference.org/ref/esri/
- **EPSG Registry:** https://www.epsg-registry.org/, http://spatialreference.org/ref/epsg/
- **EPSG:4326 (geo-referencing, visualization)**
  http://spatialreference.org/ref/epsg/wgs-84/
- **ESRI:54012 (area calculation, visualization)**
  http://spatialreference.org/ref/esri/world-eckert-iv/

NEW

- **Handling of Geographic Coordinates**
  - Geographic coordinates will consist in pairs of (x,y) numerical values handled in the spatial reference system considered
  - Need to use Decimal Degrees (DD) format for data exchange
  - 2 main recommended methods:
    - Handling Longitude / Latitude separately (in a table => 2 separate columns)

    → Avoid any issue of *Lat/Lon Axis Ordering,* for which geospatial standards diverge

    → Not Standard

    - Rely on the OGC **Standard** Well-Known-Text (WKT)

    → Simple string representation of the geometry

    → Handling coordinates all together (in a table => 1 single column)

    → Axis ordering: Longitude / Latitude

    Example: `POINT(-44.3 60.1)`

    → Can be complemented with SRID = "Extended" WKT (EWKT) – Not a standard but a best practice.

    Example : `SRID=4326;POINT(-44.3 60.1)`

NEW

- **Handling of Geographic Coordinates**
  - Case of geographic classification/coding systems
    - When available, geographic classification / coding systems should be used and characterized in the dataset

      eg Statistical Reporting units, CWP grid codes

  - Use of Degree Minutes Seconds (DMS) Notation?
    - Used for official geographic area reports and publications (legal context)
    - Enumeration of geographic coordinates using the Degrees-Minutes-Seconds (DMS) notation.

      Example: 40°11’15’’ W (in DD: Lon - 40.1875)

    Recommendation:

    Use of DMS for legal documents, always accompanied with digital files providing coordinates in decimal degrees (DD) in the recommended geographic data formats.

- **Geographic classification & coding systems**

NEW

  - Summarized as “Geographic systems”
  - Geographic classification systems
    - Definition

A *geographic classification system* can be defined as a way of grouping and organizing geographic references (reference points, lines or areas) to be used as reference data for geo-referencing statistical datasets. To facilitate its use, a geographic classification system is generally complemented by a *coding system* for the elements that compound the classification. A geographic classification system can be hierarchical (e.g. nested areas, grid cells with various resolutions) or not. It may also be time-dependent (e.g. change of area boundaries over time).

    - Types

Irregular Area classification systems: e.g. Country & territories boundaries, FAO Major areas for fishing purpose, Reporting areas, Exclusive Economic Zones, fishing zones.

Grid classification systems: System defined by a regular geo-referenced grid characterized by (i) a maximum geographic extent or scale (global, regional, local), (ii) a grid unit/cell shape (e.g. square, rectangle), (iii) a grid resolution (e.g. 1 x 1deg, 5 x 5 deg).

Linear classification systems: System defined by elements characterized by a linear shape, e.g. Haul trajectories.

Locations: System defined by elements characterized by points (locations), e.g. Landing sites

- **Geographic classification & coding systems**
  - Geographic coding systems
    - **FAO Major areas – General**
    - **Grid coding systems**
      - Definition

NEW

A grid coding system can be defined as the logic associated to a grid classification system that allows converting a pair of geographic coordinates (Longitude / Latitude) into a string-based code, and vice-versa. In the computing field, coding will mean both encoding (to obtain a grid cell code from a pair of geographic coordinates) and decoding (obtain the geographic coordinates - center - for a given grid cell code). For a same Grid classification system, there can be different mechanisms to encode/decode, i.e. different grid coding systems.

- CWP areal grid coding system
- Introduce other recommended coding systems:

  Grid C-Square system (built by CSIRO)

  → compatible with CWP areal grid coding system

- **Water main areas**
- **FAO Major Fishing Areas for Statistical Purpose**

Content recycled from http://www.fao.org/cwp-on-fishery-statistics/handbook/general-concepts/fishing-areas-for-statistical-purposes/en/

- **Areal Grid System**

Content recycled from http://www.fao.org/cwp-on-fishery-statistics/handbook/general-concepts/major-fishing-areas-general/en/

- **Countries or Areas**

Content recycled from http://www.fao.org/cwp-on-fishery-statistics/handbook/general-concepts/country-or-areas/en/)

- Include definitions of *Water Jurisdiction Areas*

  Need to refer to UNCLOS definitions of: NEW
  - **Internal and Archipelagic Waters**
  - **Territorial Seas**
  - **Contiguous Zones**
  - **Exclusive Economic Zones**
  - **International Waters / High seas / Areas Beyond National Jurisdiction**

• Geographic Information formats & protocols

- Not in the Handbook GIS section, but put under a dedicate page on **CWP Data sharing and protocols** standards.

- Recommendation of already internationally –recognized standards, mainly from:
  - International Organization for Standardization (ISO)
  - Open Geospatial Consortium (OGC).

- **Geographic Information formats & protocols**

NEW

  - **Geographic DATA**
    - **FORMATS**
      - **CSV combined with:**
        - **OGC WKT (for handling coordinates) – as flexible format**
        - **CWP Coding systems (eg FAO Areas, Grid codes)**
      - **Any OGC Data Format**
        - **Geographic Markup Language (GML) = official standard format for geographic datasets endorsed by both OGC and ISO (ISO 19136:2007)**
        - **GeoJSON, NetCDF-CF, etc.**
      - **ESRI ShapeFile (Proprietary format):** Although it is recognized that is practically widely used, it is encouraged to avoid, when possible, using such proprietary format for data exchange, due to its limitations (eg length of field names, encoding issues).
    - **PROTOCOLS**
      - **OGC Web Feature Service (WFS) = international standard protocol for exchange geographic (vector) data**

- **Geographic Information formats & protocols**

  - **Geographic METADATA**
    - **FORMATS**
      - **Dublin Core (Minimum metadata standard)**
      - **ISO 19115/19139 (Geographic Metadata standard),** endorsed by the Open Geospatial Consortium (and in UE: the European INSPIRE Directive as the official metadata standard for geographic datasets).
      - **Ecological Metadata Language (EML):** for emphasis on species identification (taxonomic coverage), such as species encounters
    - **PROTOCOLS**
      - **OGC Catalogue Service for the Web (CSW) = international standard protocol for exchange geographic metadata**

Thank you for your attention