

WEST COAST GOVERNORS ALLIANCE on OCEAN HEALTH

CALIFORNIA OREGON WASHINGTON

West Coast Ocean Data Sharing Best Practices and Policies

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1. Executive Summary

- The West Coast Governors Alliance on Ocean Health has raised the coordination of and access to critical ocean and coastal geospatial data as a high priority issue that cuts across many ocean health needs.
- The West Coast Ocean Data Portal is a tool that the WCGA hopes will increase discoverability and connectivity of people and systems on the West Coast to help better inform resource management, policy development, and ocean planning on the West Coast.
- In addition to the development of the Portal, the WCGA supports Open Data Policies through the empowerment of the West Coast Ocean Data Network, a collection of data managers and users who work to increase access to data across the region.
- This Guide lays out the ways that partner organizations can increase the discoverability and interoperability of data on the West Coast by engaging in best practices and policies related to registering data in the Portal, development of metadata, web services, and catalogs, and the implementation of Open Data policies at your organization or agency.

2. Intro

- The discovery of marine and coastal data is the primary goal of the West Coast Ocean Data Portal. The goal is to help users find, connect, and use data to inform resource management, policy development, and ocean planning.
- Collecting and collating spatially-explicit databases is usually the most time consuming aspect of planning and management activities.
- The West Coast Ocean Data Network has to deal with issues of data sharing and data management best practices because of the cross disciplinary, cross sector/agency, and cross boundary nature of ocean issues like marine debris, sea-level rise adaptation, oil spill response, and coastal and marine spatial planning.
- Interoperability enables the integration of data between organizations and across applications and industries, resulting in the generation and sharing of more useful information.

- However, in order to achieve interoperability of systems and data, we need to promote common set of best practices and policy recommendations to ensure Open Data is a norm for organizations.
- The West Coast Ocean Data Sharing Best Practices and Policies Guide is an attempt to document the practices and policies that will help ensure continued interoperability of systems with the West Coast Ocean Data Portal.
- It will evolve over time as knowledge and systems mature and is dependent on the hard work and guidance of experts in the state and federal agencies, Tribal governments, and NGOs who share and manage ocean and coastal data.
- This Guide is developed for data managers who the West Coast Ocean Data Network would like to register their metadata and/or services with the West Coast Ocean Data Portal.
- The Guide helps outline steps that can be taken to register data, best practices to ensure the widest discovery of mapping services and catalogs, and policies of the WCGA to promote Open Data along the West Coast.

3. The West Coast Ocean Data Portal

- **Importance of Including Data**
 - Wider advertisement of data holding to new user groups and stakeholders.
 - Inclusion in decision-making for regional issues like sea level rise adaptation, ocean acidification, and marine planning.
 - Accessibility to non-traditional users/audiences.
 - Demonstration of regional collaboration and sharing often required by grant funding agencies.
- **How to include data in the Portal?**
 - a) Criteria for data or tool to be included:
 - The data must have 1) metadata, and link to web services or direct download.

- Data is state or regional in scale (some exceptions will be made).
- Data meets one or more priority needs of the WCGA (see Appendix C).
- It is highly recommended that metadata record exists in an FGDC or ISO standard and are accessible via a CSW (Catalog Service for the Web) endpoint or WAF (Web Accessible Folder).
- It is highly recommended data services are compliant with OGC Web Service standards (WMS) or exists as an ArcGIS Server 10 service.

b) If you have data, metadata, and web services that you would like to make accessible via the *West Coast Ocean Data Portal* ...

- First check to make sure that you have registered your resource with your state portal or clearinghouse (see appendix A). The West Coast Ocean Data Portal regularly harvests from these sources and will be included.
 - If you include data in your state portal, let the Portal Admin know the Title and UID to include it in the next harvest.
- Go to <http://portal.westcoastoceans.org/contributors/> and/or notify the Portal admin to get a username and password.

c) Registering metadata

- Collection or Catalog published through a CSW or WAF
 - Resource provider creates metadata documents (if they don't already exist).
 - Metadata document created from model template (Appendix D) with at least minimal set of required fields.
 - Each metadata document includes Uniform Resource Identifiers (URIs aka URLs) for download links, web service endpoints, and other alternative ways to access the resource.
 - Resource provider publishes metadata records on a CSW-capable data catalog or in a web accessible folder (WAF).

- Go to <http://portal.westcoastoceans.org/contributors/> and/or notify the Portal admin.
- The WCGA admin registers the resource providers data catalog or web accessible folder in the WCGA Data Portal for harvest of priority resource metadata records.
 - Harvest is done periodically (e.g. weekly or monthly)
 - Only priority resources identified in Appendix C are harvested. This can be described as filtering or 'cherry picking'
 - If new records are found they are added, removed records are deleted, and changed records are updated. This keeps the two repositories synchronized.
 - The WCGA admin verifies proper harvesting the first time and resolves any errors. This might involve making adjustments/corrections to the resource provider's metadata document.
 - Harvested documents are stored in the internal database.
 - Document attributes including Title, Abstract, Date Published, Creator, Publisher, Contact, and Constraints as well as web service and download links are extracted and displayed in the search results (Table 1).
- The WCGA data registry admin assigns additional attributes to resources
 - These attributes are terms from the WCGA-specific controlled vocabulary/taxonomy (Appendix B)
 - These attributes are maintained in the WCGA data registry database and associated with the attributes from the original metadata document.

- The WCGA data registry publishes resources through its public user interface (UI)
 - Users discover WCGA priority resources through full-text search (faceted), tag/hierarchical search (category, sub-category, theme, sub-theme, state, ACT), etc...
- Users access priority resources through links (URI's) provided in the registry (direct file download, web service endpoints, etc.)
- The WCGA data registry re-publishes resources through its CSW service
 - Other catalogs are able to query and harvest from the WCGA data registry, thus forming a federated network of data catalogs.
- Individual Resources
 - We can also upload individual metadata records if they are in a standards compliant (ISO, FGDC) XML document.
 - Contact the Portal Admin to walkthrough manual registry process. It is also easy!

Metadata Format	Date Published	Creator	Publisher/Source	Contact Name/Email & Position	Constraints	Online Linkages
DublinCore	DC:Date	DC:Creator	DC:Publisher	DC:Creator	DC:rights	NA
ISO / GMD	gmd:date	gmd:CI_Responsi-bleParty	gmd:organi-zationName	gmd:pointOf-Contact gmd:electron-icMailAddress	gmd:useCon-straints	gmd:transferOptions>gmd:MD_DigitalTransferOptions>gmd:onLine>gmd:CI_OnlineRe-source>gmd:linkage>gmd:URL>
FGDC	caldate	<origin>	metadata.id- info.cita- tion.citein- fo.pubin- fo.publish	<ptcontac><cn- tper> & <pt- contac><cn- temail>	<useconst>	<onlink>

Table 1: Metadata fields from different formats that we access and publish information from

- **How to consume data in the portal?**
 - Go to <http://portal.westcoastoceans.org/connect/>.
 - We offer the catalog as a CSW, Esri REST API, OpenSearch API, and Solr API endpoint.
 - Copy the endpoint URL and use in the catalog software of your choosing.
 - If asks for catalog type, indicate 'Geoportal'

- **Best Practices for registering and consuming West Coast Registry Data**
 - Data providers should be accountable and responsible for managing their own data (i.e., updates, metadata, data-source server issues, and web services).
 - Data providers should employ a "collection" metadata record for data types with multiple data layers and/or services that point to: (1) single web folder collection of child metadata records, (2) web mapping application (e.g. NowCoast), data viewer (e.g. bathy data viewer), Catalog (e.g. IOOS).
 - Data providers should make metadata accessible from a CSW enabled endpoint or Web Accessible Folder (WAF).
 - Where possible make use of existing keywords from established taxonomies. For example, the WCGA Data Taxonomy (Appendix B).

3. Metadata

- **Importance**
 - The focus has traditionally been on documentation of science behind data. We are experiencing a transition that emphasizes metadata's role in data discovery for use by other systems and people. This function of metadata is becoming critical as web services and data download linkages are increasingly packaged with the metadata.

- What do these improvements mean to the end users ability to discover/use the data?
- **Resource discovery**
 - Complete and published metadata increases the number of remote systems that can discover resources that would otherwise be “hard to find”. This can help reach non-traditional audiences increasing the chance of citation of data in new and novel applications.
 - Allowing resources to be found by relevant criteria;
 - Identifying resources;
 - Bringing similar resources together;
 - Distinguishing dissimilar resources;
 - Giving location information.
- **Organizing e-resources**
 - Organizing links to resources based on audience or topic.
 - Building these pages dynamically from metadata stored in databases.
- **Facilitating interoperability**
 - Using defined metadata schemes, shared transfer protocols, and crosswalks between schemes, resources across the network can be searched more seamlessly.
 - Metadata harvesting, e.g., OAI protocol, CSW, WAF.
- **Digital identification**
 - Elements for standard numbers, e.g., ISBN
 - The location of a digital object may also be given using:
 - a file name
 - a URL
 - some persistent identifiers, e.g., PURL (Persistent URL); DOI (Digital Object Identifier)
 - Combined metadata to act as a set of identifying data, differentiating one object from another for validation purposes.

- **Archiving and preservation**
 - Challenges:
 - Digital information is fragile and can be corrupted or altered;
 - It may become unusable as storage technologies change.
 - Metadata is key to ensuring that resources will survive and continue to be accessible into the future. Archiving and preservation require special elements:
 - to track the lineage of a digital object,
 - to detail its physical characteristics, and
 - to document its behavior in order to emulate it in future technologies.

- **Types**

There are a large number of metadata standards which address the needs of particular user communities. The first four profiled below primarily support discovery and access. They are progressively more complex to implement and more specialized to particular domains.

 - **Dublin Core Metadata Element Set**
 - The Dublin Core Metadata Element Set (ISO Standard 15836) is a basic standard which can be easily understood and implemented and as such is one of the best known metadata standards. It consists of 15 elements which address the most basic descriptive, administrative and technical elements required to uniquely identify a digital resource. Most resource discovery metadata standards can be mapped to the Dublin Core Metadata Element Set, enabling basic federated searching across metadata created using a number of different standards, without detracting from richer metadata held elsewhere.
 - See <http://dublincore.org/> for more information on the Dublin Core Metadata Initiative.

- **ISO 19115: 2003(E) — Geographic Information: Metadata**
 - ISO 19115 was developed by the geospatial community to address specific issues relating to both the description and the curation of spatial data. This standard can be used for describing digital or physical objects or datasets which have a spatial dimension. The standard also includes methodologies for creating application profiles, metadata extensions and hierarchical metadata and provides implementation examples. Geospatial professionals have developed a number of profiles of this standard to fit particular uses: for example, the Australia New Zealand Land Information Council (ANZLIC) Metadata Profile, the North American Profile (NAP), and the UK GEMINI profile. The standard's accompanying XML schema, ISO/CD TS 19139 Geographic information — Metadata — enables interoperable XML expression of ISO19115 compliant metadata.
 - For more information and to acquire the ISO 19115 documentation, see http://www.iso.org/iso/catalogue_detail.htm?csnumber=26020.

- **ISO 19115 Part 2: 2009 - Geographic information - Metadata - Part 2: Extensions**
 - ISO 19115-2:2009 extends ISO 19115:2003 by defining the schema required for describing imagery and gridded data. In practice, this schema is used to document other types of instrumentation beyond imagery as well. It provides information about the properties of the measuring equipment used to acquire the data, the geometry of the measuring process employed by the equipment, and the production process used to digitize the raw data.
 - For more information and to acquire the ISO 19115-2 documentation, see http://www.iso.org/iso/catalogue_detail.htm?csnumber=39229.

- **Federal Geographic Data Committee Content Standard for Digital Geospatial Metadata (FDGC CSDGM)**

- The standard commonly referred to as FGDC (although FGDC is the maintenance agency, and “CSDGM” is the actual element set) is a large and early metadata standard for geospatial information created by agencies of the US federal government. The FGDC web site describes the scope of this standard as to allow users to “determine the availability of a set of geospatial data, to determine the fitness [of] the set of geospatial data for an intended use, to determine the means of accessing the set of geospatial data, and to successfully transfer the set of geospatial data.”
- The current production version of FGDC is 2.0, from 1998. Since this time, an international standard for geospatial information (ISO 19115) has emerged. Plans have been announced to create a US national geospatial metadata standard as a profile of ISO 19115, and to create version 3.0 of CSDGM as an implementation of that. This work has not yet been finalized.
- For more information on the FGDC standards, see <http://www.fgdc.gov/standards/projects/FGDC-standards-projects/metadata/base-metadata/index.html>.

- **Ecological Markup Language (EML) -**

- EML is a specification intended to support the description of any type of ecological information, including raw data, published research papers, rights information, and research protocols. At the highest level, EML models four primary entities: datasets, literature, software, and protocols.
- For more information about EML, see <http://knb.ecoinformatics.org/software/eml/>.

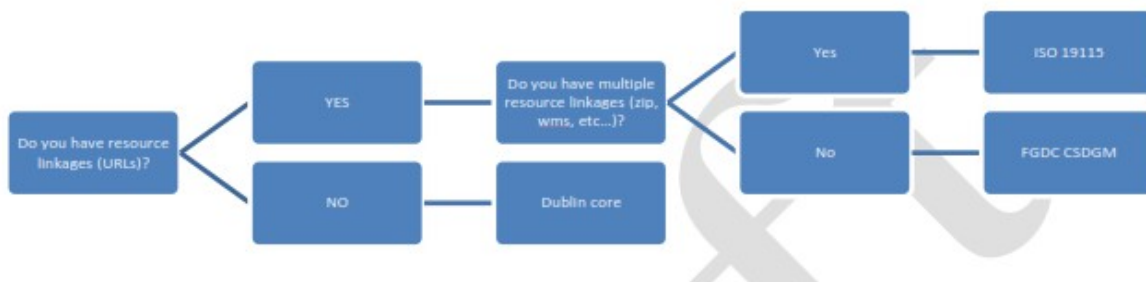


Figure 1: Decision tree to determine which metadata standard might be best suited for your data collection.

- **Metadata Best Practices**

- If packaging services with data, encourage use of the ISO metadata standard.
- Provide direct URL to online resources in metadata in online linkages sections.
- Use the appropriate metadata structure to describe the download or access URL.
- Write descriptive titles and abstracts.
- Include terms found in published taxonomies in your metadata, West Coast Ocean Data Portal Taxonomy can be found here (Appendix B).
- Reference browse graphics or thumbnails with accessible URLs.
- Collections or series of homogeneous data need collection level and member level.
- Use real dates, not “present” or “now” to describe time period of content.
- Use the position and organization name instead of an individual’s name, unless the dataset truly was an individual’s effort - i.e., a researcher who owns the dataset.

4. Web Services

- **Importance**

- Web services provide an open, interoperable, and highly efficient framework for using distributed data resources in common systems.

- They are interoperable because each piece of software communicates with each other piece via the standard RESTful, SOAP and XML protocols.
- It is important to know that there are a variety of service standards that can either be sector-specific (e.g. AIS) or vendor-specific services (e.g. Esri GeoServices REST specification, NetCDF). OGC Web Services are considered to be “open services” agnostic of sector or vendor.
- Web Mapping Services comprise a lot of different kinds of services in addition to familiar maps:
 - mapping services - to get a map image
 - data services - to get coordinates of map features or attributes about the features
 - geocoding or address matching services - to get a coordinate for an address
 - geoprocessing services - to get information about feature shapes or to modify those shapes
- **Types**
 - A **Web Map Service** (WMS) defines an interface that allows a client to get maps of geospatial data and gain detailed information on specific features shown on the map. [More information on WMS...](#)
 - A **Web Feature Service** (WFS) allows a client to perform data manipulation operations on one or more geographic features. WFS offers direct fine-grained access to geographic information at the feature and feature property level. [More information on WFS...](#)
 - A **Web Processing Service** (WPS) provides access to calculations or models which operate on spatially referenced data. [More information on WPS...](#)
 - **Catalogue Services for the Web** (CSW) provide a registry service to support the ability to publish and search collections of descriptive information (metadata) for data, services, and related information objects. [More information on CSW...](#)

- A **Web Map Context** (WMC) document specifies how a grouping of one or more maps coming from one or more Web Map Services servers can be described in a portable, platform-independent format for storage in a repository or for transmission between clients. [More information on WMC...](#)
- A **Web Map Tile Service** (WMTS) provides access to cartographic maps of geo-referenced data. [More information on WMTS...](#)
- A **Web Coverage Service** (WCS) defines a standard interface and operations that enable interoperable access to geospatial coverages consisting of intact, raw data. [More information on WCS...](#)
- A **Gazetteer** is an online "dictionary" of geospatial words or terms, with or without applicable feature geometries. The **Gazetteer Service** can be used to relate place names to stored geometry. [More information on the Gazetteer Service...](#)
-

There are a variety of mapping engines to provide these web mapping services - ArcIMS (Esri), ArcGIS for Server (Esri), GeoServer (open source), and Map Server (open source). No engine provides all services.

- **ArcIMS** is an Esri web mapping engine that uses Arc XML (aka AXL) syntax for requests and responses. It is an end-of-life system. ArcIMS can provide map images, data and geocode results. <http://www.esri.com/software/arcgis/arcims>
- **ArcGIS for Server** is an Esri web mapping engine that replaces ArcIMS and should be used instead of ArcIMS for new users. ArcGIS for Server can use a proprietary API or OGC API (limited). ArcGIS for Server can provide map images, data, geoprocessing and geocode results. <http://www.esri.com/software/arcgis/arcgisserver>
- **GeoServer** provides OGC-standard WMS/WFS/WCS services. GeoServer does not geocode (turn address information into points on a map). WPS (web processing (aka geoprocessing) services) coming November 2012. <http://geoserver.org/display/GEOS/Welcome>
- **MapServer** is a widely-used Open Source platform for publishing spatial data and interactive mapping applications to the web. <http://mapserver.org/>

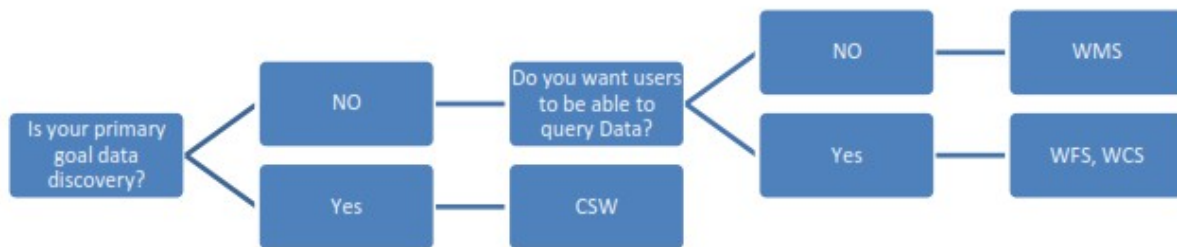


Figure 2: Decision tree to determine which web services are most appropriate for your data and audience.

- **Web Service Best Practices**

- Where possible provide OGC and sector/vendor-specific services and to ensure maximum interoperability with a variety of systems.
 - Any data that is served from an ArcGIS for Server as Esri REST services can be easily also served as OGC services without a lot of secondary effort, simply by 'enabling' OGC services in the ArcGIS for Server settings. Whenever possible/practical, both options should be enabled as best practice.
- Web services should specify the version and last update date for the source data, as well as link to the source metadata.
- In order to support the broadest range of user needs, from casual users viewing data through web browser to desktop .NET developers, web services should provide both REST and SOAP-based services.
- Use a map server that supports all OGC standards applicable to the project objectives, preferably WMS, WMTS, and WFS at a minimum. GeoServer and ArcGIS for Server provide two popular options.
- If developing a slippy map, render and serve all data that does not require frequent update as cached tiles, in compliance with the WMTS standard. GeoWebCache, which extends GeoServer, is a popular tile server.
- If serving a single map image or data that requires frequent update but not feature queries, provide a standards-compliant WMS.

- If serving data with individual features that may be queried or changed by the client, provide a standards-compliant WFS.
- If providing multiple data sources and/or services to the public, also provide a CSW with ISO-compliant metadata for each service.

5. Catalogs

- **Importance**

- With the abundance of geospatial resources available today, technologies such as catalog services, are necessary to facilitate data discovery, retrieval, and maintenance.
- Because of standardized interface specifications, clients of different origins and with potentially different focuses can access this technology and the geospatial metadata to which it provides potential access.
- Since these interfaces are standardized, a major role in the development of catalog services is left to developers, defining information models which can be utilized by these interfaces and yet remain independent of the underlying metadata.

- **Types**

- **Web Accessible Folders (WAF)**

- A Web Accessible Folder (WAF) is an HTTP accessible directory of files, typically metadata files in XML format in which all files and their time-stamps are visible to a web browser or client. They represent an easy/lightweight way to share metadata, although they are limited in their ability to support higher level search and harvesting of records.

- **Catalog Service for the Web**

- Catalog Service for the Web' (**CSW** or sometimes seen as **Catalog Service - Web**) is a standard for exposing a catalogue of geospatial records on the Internet (over HTTP). CSW is one part (or "profile") of the [OGC Catalog Service](#), which defines

common interfaces to discover, browse, and query metadata about data, services, and other potential resources.

- The catalogue is made up of metadata records that describe these types of data:
 - geospatial data (e.g. KML)
 - geospatial services (e.g. WMS)
 - other related resources
- The format of each metadata record is defined in the standard only as XML, but is typically an encoding of Dublin Core, ISO19139 or FGDC metadata and with UTF8 character encoding. Whatever format is used, each record must contain a set of core fields, such as: Title, Format, Type (e.g. Dataset, DatasetCollection or Service), BoundingBox (a rectangle of interest, expressed in latitude and longitude), Coordinate Reference System and Association (a link to another metadata record). These sophisticated metadata sharing approaches support high level search requests of resources within the catalog.
- Requests include:
 - GetCapabilities - returns the properties of requests that are accepted by the server
 - DescribeRecord - returns info about the model of records
 - GetDomain (optional) - returns for a given record field, the range of values held by records
 - GetRecords - search for records, returning record IDs
 - GetRecordsById - returns records, specified by their ID
 - Harvest (optional) - create/update metadata by asking the server to 'pull' metadata from somewhere
 - Transaction (optional) - create/edit metadata by 'pushing' the metadata to the server

- **Catalog Server Software Options**

■ **PyCSW** - <http://pycsw.org/>

- The main focus of PyCSW is providing a very lightweight Python CSW server solution. Another goal is to allowing you to quickly publish your metadata repository and make your resources discoverable. A number of data catalog projects including CKAN, have begun using PyCSW to provide their CSW harvesting and serving capabilities.
- Links (CSW Capabilities provided by PyCSW)
 - [Inside Idaho - Idaho's state geospatial](#)
 - [Open Data Philly](#).

■ **GeoNetwork** - <http://www.geonetwork-opensource.org>

- GeoNetwork is a mature data catalog product and is one of the flagship projects of OSGeo.
- GeoNetwork is popular outside the US and has excellent support for the EU INSPIRE initiative. GeoNetwork is increasingly developed in lock-step with other open source GIS projects including GeoServer, GeoWebCache, and GeoNode.
- Links (CSW capabilities provided by GeoNetwork)
 - [Oregon Coastal Atlas](#)

■ **Esri Geoportal Server-**

<http://www.esri.com/software/arcgis/geoportal>

- Esri Geoportal is a mature data catalog product created by Esri, and is now open source. It is in widespread use by state and federal agencies that have traditional GIS departments.
- Links (CSW capabilities provided by Geoportal)
 - [Oregon Spatial Data Library](#)
 - [National Geophysical Data Center Geoportal](#)

■ **CKAN** - <http://ckan.org/>

- CKAN was created by the Open Knowledge Foundation (OKFN) in the United Kingdom and is the data catalog platform behind data.gov.uk. CKAN is now beginning to catch on in the US. It was recently chosen to become the new data catalog behind data.gov and geo.data.gov.
- CKAN now employs PyCSW (above) as its CSW engine.
- Links (CSW capabilities provided by CKAN)
 - Data.gov

■ THREDDS Data Server (TDS)

- A web server that provides metadata and data access for scientific datasets, using OPeNDAP, OGC WMS and WCS, HTTP, and other remote data access protocols.
- TDS can be used to create a virtual directories of available data and their associated metadata and present a combined file that a user sees and can access as a single file containing the data.
- Provided by Unidata and In widespread use by NOAA offices and the Ocean Observing Community.
- Links
 - CenCOOS Catalog

• Best Practices

- Advertise your CSW endpoint so that people can readily access it through an 'API' or 'Developer' tab.
- Esri Geoportal and CKAN both provide comprehensive open source catalog software options that have been adopted by a wide user community and are recommended.
- Publish only your original metadata/data.

6. WCGA Data Sharing Policy



- General Statement - The WCGA and the West Coast Ocean Data Portal seek to promote and advocate the spirit of “open data” to ensure that data products are made freely and readily accessible to our stakeholders and the public in machine readable formats.
- Data/metadata format and standards - WCGA and West Coast Ocean Data Portal ACT will ensure compatibility with federal requirements, and any data generated through grant activities be required to complete ISO or FGDC metadata and generate OGC Services.
- Data Authorship and Citation – The WCGA will strive to advertise information related to the original authors of the data that is discoverable through our portal. It is vitally important to recognize contributions from our partners by providing the original source and citation for any data.
- Data stewardship and preservation - Contracting Institutions and state agencies will work with their respective state data network and Geoportal to identify long term hosting and publishing custodians for any original data created. This will include the requirement that such custodians have the ability to publish metadata and WMS in a way accessible to the West Coast Data Registry (Catalog standard, Web accessible folders, etc). The custodians will also be required to notify the West Coast Ocean Data Portal Coordinator of new data made available to their state geoportal so that the West Coast Ocean Data Portal Coordinator can target that new dataset for inclusion in the Data Registry. Similarly, and data development or enhancement projects will be subject to the same requirements (i.e. custodians are identified at the state or partner level, metadata and WMS are generated and published online, West Coast Ocean Data Portal Coordinator is contacted).
- Access to original data will be made available through both the respective state or Network geoportal as well a West Coast Data

Registry. The West Coast Registry will then republish resources for harvesting by the federal ocean.data.gov.

9. Conclusion

- The proliferation of high quality GIS data have put an increasing demand to utilize that data in ocean resource management, policy development, and planning.
- The cross sectoral/cross agency nature of ocean management has placed a high premium on the interoperability of data from multiple and varied sources.
- Discovery of relevant data is often a big hurdle in accessing and using data for a specific purpose.
- Metadata describing a dataset is increasingly being utilized as a discovery mechanism when created in standards compliant format and published through a standards compliant Catalog.
- The adoption of Open Data Policies and support for roles within organizations to support these policies will greatly increase the ability of West Coast institutions and organizations to share data and inform ocean health issues in a timely and efficient manner.

10. WCGA point of Contacts

- West Coast Ocean Data Portal Admin, portal@westcoastoceans.org
- Todd Hallenbeck, Program Coordinator, todd.r.hallenbeck@westcoastoceans.org
- Andy Lanier, ACT Co-Chair, andy.lanier@state.or.us
- Steve Steinberg, ACT Co-Chair, steves@sccwrp.org

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http://www.westcoastoceans.org/media/Data_Network_ACT/WCGA_RDF_Data_Registry_Design_Assessment_2013.pdf

- OGC Catalog Service: <http://www.opengeospatial.org/standards/cat>
- Open Geospatial Consortium Inc., Date: 18 October 2006, Reference number of this OpenGIS® project document: OGC 06-129r1, Version: 0.0.12, Category: OpenGIS® Catalogue Service Application Profile, Editors: Patrick Neal, John Davidson, Bruce Westcott

Appendix A: List of State and Regional portals, registries, and clearinghouses

State Registries

California - CA Geoportal

<http://portal.gis.ca.gov/geoportal/catalog/main/home.page>

Oregon - Oregon Spatial Data Library

<http://spatialdata.oregonexplorer.info/geoportal/catalog/main/home.page>

Washington - Washington State Geospatial Clearinghouse

<http://metadata.gis.washington.edu/geoportal/catalog/main/home.page>

Oceanographic Data Portals

SCCOOS - <http://www.sccoos.org/interactive-map/>

CeNCOOS - <http://139.121.160.34/CeNCOOS/DataPortal.html>

NANOOS - <http://nvs.nanoos.org/>

Seafloor Mapping Data Portals

PaCOOS <http://pacoos.coas.oregonstate.edu/help.html>

SeafloorMapping.net http://seafloormapping.net/sf_data

California SeaFloor Mapping Program:

<http://seafloor.otterlabs.org/csmp/csmp.html>

Appendix B: WCODP Discovery Ontology

Category	Subcategory	Theme	Term	Definition
Physical				<i>Relating to the physical environment, e.g., atmosphere, water, earth</i>
	Atmosphere			<i>Processes and phenomena of the atmosphere, e.g., wind, air quality</i>
		Winds		<i>Realtime or historic measurements of surface winds, vorticity, and wind stress</i>
			Surface Winds	<i>Wind magnitude and direction measured at the surface (generally 10m above the ground).</i>
			Vorticity	<i>Describing the circular (cyclonic or anti-cyclonic) motion of air.</i>
			Wind Stress	<i>Related to the shear stress exerted on a large body of water.</i>
		Air Quality		<i>Realtime or historic measurements of air quality, including CO2, emissions, particulates, and visibility</i>
			CO2	<i>Related to the atmospheric concentration of CO2</i>
			Emissions	<i>Measurements of the concentration, distribution, and sources of emissions</i>
			Particulates	<i>Related to the atmospheric concentration of particulate matter.</i>
			Visibility	<i>Related to the transparency of air. Alternatively, related to the distance at which objects can be seen clearly</i>
		Precipitation		<i>Realtime or historic measurements of rain or snow, including precipitation rate, anomalies, and amounts</i>
			Precipitation Rate	
			Precipitation Anomaly	
			Precipitation Amount	
		Temperature		<i>Realtime or historic measurements of air temperature, including surface air temperature, anomalies, profiles, and air temperature</i>

			Surface Air Temperature	
			Temperature Anomaly	
			Temperature Profile	
			Air Temperature	
	Land Surface			<i>Processes and phenomena of the solid earth, e.g., elevation, substrate, geologic features, land cover, lithology, minerals, backscatter, shorelines, offshore rocks, littoral cells</i>
		Elevation		<i>Related to measurements of height above a fixed reference point (vertical datum)</i>
			Contours	
			Surface Roughness	
			Digital Elevation Model	
		Substrate	*	<i>Related to the composition of earth's surface, including those associated with fresh and marine water bodies</i>
			Lithology	<i>Related to the physical characteristics (rock type, texture, color, etc.) of the seabed</i>
			Soils	<i>Related to soil composition or type.</i>
			Sediments	<i>Related to sediment origin, chemistry, composition, texture, structure or sequence.</i>
			Minerals	<i>Related to the location and deposition of minerals</i>
		Geomorphic Landforms/Processes	*	<i>Related to the coastal and oceanic landforms and the process that shape them</i>
			Erosion	
			Tectonic Landforms and Processes	<i>Related to tectonics or physiographic setting</i>
	Oceans			<i>Processes and phenomena of water bodies,</i>

				<i>e.g., oceans, estuaries, inland waters, oceanography, tides, currents, pH, DO2</i>
		Bathymetry		
			Offshore Rocks and islands	<i>Oceanic landforms that exist all or partially above high tide line</i>
			Reefs and Seamounts	<i>Offshore a ridge of rock, coral, or sand just above or below the surface of the sea.</i>
			Contours	
			Surface Roughness	
			Digital Elevation Models	
		Marine Substrates		
			Lithology	
			Soils	
			Sediments	
			Minerals	
		Water Quality & Chemistry		<i>Related to the measurements of the physical and chemical properties of water</i>
			Dissolved oxygen	<i>Related to the measurements of oxygen in ocean bodies</i>
			pH	<i>Real time or historic measurements or models of ocean acidity</i>
			Salinity	<i>Real time or historic measurements of ocean salinity</i>
			Temperature	
		Waves		
			Wave height	<i>real time or historic measurements of models of significant wave height</i>
		Coastal Processes		
			Littoral Cells	<i>Naturally or human delineated compartments of the coast that contain a complete cycle of sedimentation</i>
			Shorelines	<i>Related to lines that delineate land and water</i>
		Circulation		<i>Related to chemical or physical characteristics of salt water bodies of water</i>
			Currents	<i>Related to the historical or real time direction,</i>

				<i>speed, or velocity of energy through the ocean</i>
			Tides	<i>Related to the hieght, range, or frequency of periodic rising and falling of coastal seas.</i>
	Estuaries			<i>Related to the location, chemical physical composition, and movement of energy though brackish coastal water bodies</i>
		Bathymetry		
		Water Quality & Chemistry		
			Dissolved oxygen	
			pH	
			Salinity	
			Temperature	
		Circulation		
			Currents	<i>Related to the historical or real time direction, speed, or velocity of energy through the ocean</i>
			Tides	<i>Related to the hieght, range, or frequency of periodic rising and falling of coastal seas.</i>
		Water Quality		
	Freshwater		*	<i>related to characteristics of stream, rivers, and lakes</i>
		Water Quality & Chemistry		<i>Real time or historic measurements or models of the amount of chemical, biological, or sediment pollutants in oceans</i>
		Watershed Characteristics		<i>naturally delineated segments of land that separate waters flowing to different rivers, basins, or seas.</i>
		Surface Water		<i>related to the movement of water over land</i>
			Wetlands	
			Lakes	
			Rivers and Streams	
			Canals	
Biological				<i>Flora and/or fauna in natural environments e.g. Species and taxa, habitats, ecosystems,</i>

			<i>marine education</i>
	Species and Habitats		<i>Pertaining to life history, habitat, and distribution of marine species and taxa, e.g., birds, marine mammals & turtles, fish, invertebrates, phytoplankton & zooplankton, marine plants & algae</i>
		Birds	<i>Shore, sea, and land birds</i>
		Marine Mammals and Turtles	
		Fish	<i>Freshwater and saltwater fishes</i>
		Invertebrates	<i>sponges, corals</i>
		Phytoplankton and Zooplankton	
		Marine Plants and Algae	<i>macroscopic plants and algae - seaweeds, seagrasses, kelps</i>
		Pelagic Zone	<i>Habitats associated with the open ocean, include photoic, euphotic, and epipelagic zones.</i>
		Nearshore	<i>Habitats associated with the intertidal and subtidal zones of coastal ecosystems</i>
		Seafloor	<i>Habitats associated with the ocean seafloor, including continental shelf and slope, as well as the abyssal plain</i>
		Estuarine	
		Coastal	<i>Habitats of the coastal zone, including beaches, dunes, coastal vegetation, etc...</i>
		Terrestrial	
		Freshwater	<i>Habitats of freshwater ecosystems, including water column and benthos of rivers and lakes.</i>
	Ecosystems and Functions		<i>Pertaining to process and services of the ecosystem, e.g., carbon sequestration, water filtration, water storage, species and habitat biodiversity, ecosystem assemblages</i>
		Carbon sequestration	
		Water Filtration	

		Water Storage		
		Species and Habitat Biodiversity		
		Species assemblages		
		Invasive species		
Human				<i>Patterns and process of the human society. These patterns and processes are regulated by human resources (infrastructure) and regulations (boundaries, plans, and management), e.g., boundaries, infrastructure, management, economy, demographics and culture, marine education.</i>
	Boundaries			<i>Legal lines defining land ownership, jurisdiction, or political boundaries, e.g., administrative boundaries, cadastral, jurisdictional, land use zoning, urban growth boundaries.</i>
		Administrative		
		Cadastral		
		Jurisdictional		
		Planning		<i>Pertaining to comprehensive plans enacted to address long term land use goals or specific resource management goals. Also can include emergency preparedness and resilience planning.</i>
			Zoning	
			Estuary Plans	
			Local Comprehensive Plans	
			Marine Spatial	

			Plans	
			Emergency response plans	
			Urban Growth Boundaries	
	Management		*	<i>Pertaining to the management of human uses of the ocean for safety, conservation, or commercial activities, e.g., watershed units, conservation, energy, aquaculture, marine debris, sediment management, estuary plans, local plans, public access, marine spatial plans.</i>
		Water Management		
			Watershed Protection/Restoration	
		Conservation		<i>e.g. critical habitats, EFH</i>
		Land Management		
			Land Cover/Land Use	
		Sediments		
		Aquaculture		
		Marine Debris		
		Energy		
		Scientific Research		
		Emergency		
		Public Access		
		Military		
	Hazards			
		Natural		
			Landslides	
			Floods	
			Sea Level Rise	
			Tsunamis	
		Man-Made		

			Unexploded Ordnances	
			Oil Spills	
	Infrastructure			<i>Man-made construction, e.g., utilities, buildings, ports, fish culture facilities, shoreside protective structures, housing, transportation, dams, research, emergency facilities, navigational aids, storm drains, outfalls, communication cables</i>
		Utilities		
			Pipelines	
			Sewer mains	
			Storm Drains	
			Outfalls	
			Cables	
		Structures		
			Critical facility structures	
			Shore Protective Structures	
			Buildings	
			Research Stations	
			Dams	
		Transportation		
			Ports	
			Shipping Lanes	
			Navigational Aids	
			Airports	
			Roads	
			Railroads	
	Economy			<i>Pertaining to the aspects of the coastal economy, e.g., shipping, commercial and recreational fishing, non consumptive recreational uses, aquaculture, energy</i>
		Maritime		

		Industry		
			Shipping	
			Marine supply	
		Fishing		
			Commercial	
			Recreational	
		Recreation (non- consumptive)		
			Tourism	
			Boating	
		Cultivation		
			Agriculture	
			Aquaculture	
		Energy		
			Wave	
			Wind	
			LNG	
			Nuclear	
			Coal	
			Tidal	
		Natural Resources		
	Population			<i>Pertaining to data associated with demographics</i>
		Population Density		
		Wages		
		Demographic s		
		Census		
		Social Behavior		
	Heritage			<i>Related to cultural resources and culturally important areas</i>
		Shipwrecks		
		Cultural Heritage Sites		

Topic				
Marine Debris				
	Debris Type			
	Policy			
	Sensitive Marine Areas			
	Source			
	Transport			
Coastal Hazards				
	Sea Level Rise			
	Tsunamis			
	Coastal Flooding			
	Storms			

Appendix C: WCODP Data Priorities – Sept 2014

WCODP Draft Priorities - June 2014	
Data Category	Data Theme
Biological/Species and Habitats	Seabird Hotspots
Biological/Species and Habitats	Seabird Nesting Sites
Biological/Species and Habitats	Marine Mammal Hotspots
Biological/Species and Habitats	Marine Mammal Migration
Biological/Species and Habitats	Marine Mammal Haulouts
Biological/Species and Habitats	Kelp
Biological/Species and Habitats	Seagrasses
Biological/Species and Habitats	Corals and Sponges
Biological/Species and Habitats	Shellfish Distribution/Hotspots
Biological/Species and Habitats	Invertebrates
Biological/Species and Habitats	Fish Diversity Hotspots
Biological/Species and Habitats	Fish Distribution
Physical/Atmosphere	Winds
Physical/Oceans	Upwelling

Physical/Oceans	pH
Physical/Oceans	Coastal hypoxic zones
Physical/Oceans	SST
Physical/Oceans	Physiography
Physical/Oceans	Induration
Physical/Oceans	Littoral Cells
Physical/Oceans	Nearshore Bathymetry/LiDAR
Physical/Oceans	Salinity
Physical/Estuaries	Estuary Habitats/Characterization
Physical/Estuaries	Estuarine Bathymetry
Physical/Freshwater	Watershed Boundary
Human/Boundaries	Counties
Human/Boundaries	EEZ
Human/Boundaries	Coastal Zones
Human/Boundaries	Shorelines
Human/Boundaries	National Marine Sanctuaries
Human/Boundaries	National Parks
Human/Boundaries	State Parks
Human/Boundaries	Land Ownership
Human/Infrastructure	Outfalls
Human/Infrastructure	Storm Drains
Human/Economy	Recreational Activities
Human/Economy	Commercial Fishing
Human/Management	Coastal Access
Human/Management	Military Activities
Human/Management	Essential Fish Habitat
Human/Management	ESA Critical Habitat (Green Sturgeon, Leatherback Turtle, Snowy Plover, Stellar Sea Lion)
Human/Management	MPAs
Human/Management	MPA Reference Sites
Human/Management	Shorezone
Human/Management	Dredge Disposal Areas
Human/Hazards	Coastal flood zones
Human/Hazards	SLR + wave surge
Human/Hazards	Tsunami Risk
Human/Culture and Demographics	Tribal Cultural Areas/Prehistoric Sites

Appendix D: ISO 19115 Metadata Template

Can be accessed at:

http://www.westcoastoceans.org/media/data_network_act/template_xml_iso19115.txt

After downloading, you can change the file extension to .xml and edit in metadata editing tools like ArcCatalog or Notepad++.

Appendix E: Projection and Coordinate System Best Practices

Geographic Coordinate System: No distortion of distance or area, intended for data visualization on the web. Not suitable for spatial analysis. Examples include oceanographic observing systems.

Geodetic Model

Horizontal Datum Name: D_WGS_1984

Ellipsoid Name: WGS_1984

Semi-major Axis: 6378137

Denominator of Flattening Ratio: 298.257224

Custom Transverse Mercator: Minimal distortion of distance and area intended for regional spatial analysis in areas that are predominantly north/south. Also good for printing of maps. Examples used in West Coast Essential Fish Habitat (NOAA), West Coast Seafloor Habitat

Scale Factor at Central Meridian: 1.0

Longitude of Central Meridian: -121.6

Latitude of Projection Origin: 31.96

False Easting: 390000

False Northing: 0.0

Planar Coordinate Information

Planar Distance Units: meters