

Linked Data: An Oceanographic Perspective

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NATURAL ENVIRONMENT RESEARCH COUNCIL

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A Web of Documents

- The familiar World Wide Web

The image shows a Google search interface with the search term 'imdis'. The search results page displays several links related to the International Conference on Marine Data and Information Systems (IMDIS) 2013. A preview of the conference website is visible on the right side of the search results.

Google Search Results for 'imdis':

- IMDIS 2013**
imdis2013.seadatanet.org/
Read the news. Published on the 22/05/2012. First announcement of the **IMDIS 2013** conference. Lucca (Italy) September 23 - 25, 2013. Read the news. Contact.
[Place and Dates](#) - [Submission](#) - [Conference Information](#) - [Registration](#)
You've visited this page 4 times. Last visit: 30/06/13
- IMDIS online secretariat v.2.6 (Oracle)**
imdis.un.org/
imdis instructions for the preparation of the 2012-2013 strategic framework - Instructions for the preparation of the 2012-2013 strategic framework.
- IMDIS - the United Nations**
www.un.org/Depts/oios/mecd/mecd_glossary/documents/.../imdis.htm
IMDIS The Integrated Monitoring and Documentation Information System is the online tool for planning, monitoring and reporting of results-based programme ...
- [PDF] integrated management and document information system**
www.un.org/Depts/oios/mecd_manual/manual.pdf
Integrated Monitoring and Documentation Information System. **IMDIS** <http://imdis.un.org>. Integrated Monitoring and Documentation Information System. **IMDIS**.
- IMDIS 2013 - IODE**
www.iode.org/index.php?option=com_content...imdis...

IMDIS 2013 Website Preview:

- IMDIS 2013**
International Conference on Marine Data and Information Systems - Lucca (Italy), September 23-25, 2013
- Navigation: [News](#) | [Conference Information](#) | [Registration](#) | [Submission](#) | [Proceedings](#) | [Practical information](#) | [Contact](#)
- Latest news: Published on the 16/07/2013
- Zoom: [Read the news](#)
- Conference Information: **IMDIS 2013**, September 23-25, 2013, Lucca, Italy
- Partners & sponsors

A Web Of Documents

The screenshot shows a web browser window with the address bar containing imdis2013.seadatanet.org, which is circled in red and labeled "URI". The website header features the text "IMDIS 2013" and "International Conference on Marine Data and Information Systems - Lucca (Italia), September 23-25, 2013". A navigation menu includes "News", "Conference Information", "Registration", "Submission", "Proceedings", "Practical information", and "Contact".

On the left side, under "Latest news", there are several news items. The first item, dated 16/07/2013, has the headline "Provisional programme available" circled in red, with a red arrow pointing to it from the text "Links to other URIs". Other news items include "Abstract submission closed" (16/05/2013), "Poster of the IMDIS 2013 conference" (06/06/2012), and "First announcement of the IMDIS 2013 conference" (22/05/2012). A "Contact" section provides the address: "29280 Plouzané".

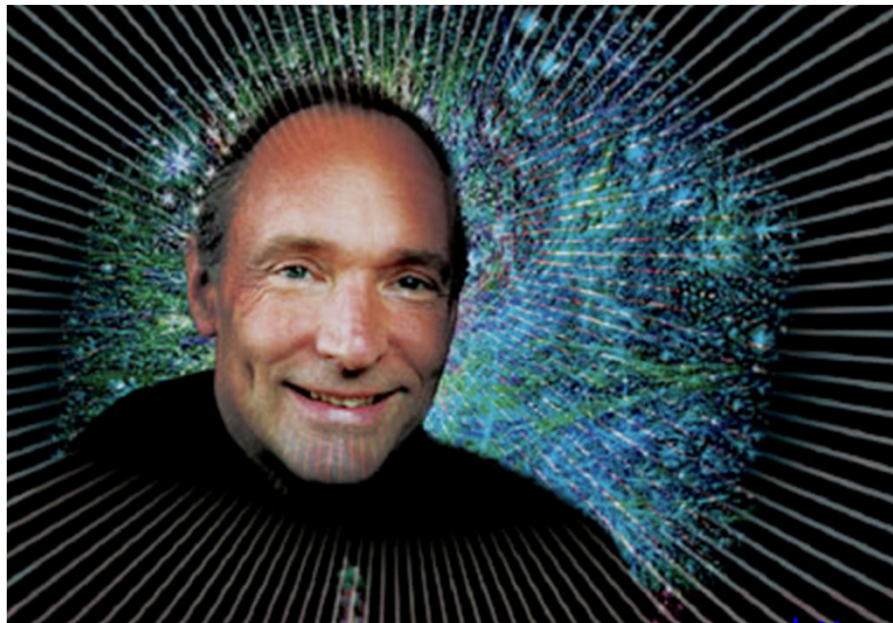
The main content area features a large image of Lucca, Italy, with the text "Lucca, Italy" overlaid. Below this is a "Practical information" section with three small thumbnail images. At the bottom, there is a "Partners & sponsors" section.

URI "resolves" to something meaningful i.e.– a web page in a standard format - HTML

Links to other URIs

A Web of Data

“If HTML and the World Wide Web made all the online documents look like one huge book, [Linked Data] will make all the data in the world look like one huge database.””



Sir Tim Berners-Lee

W3C

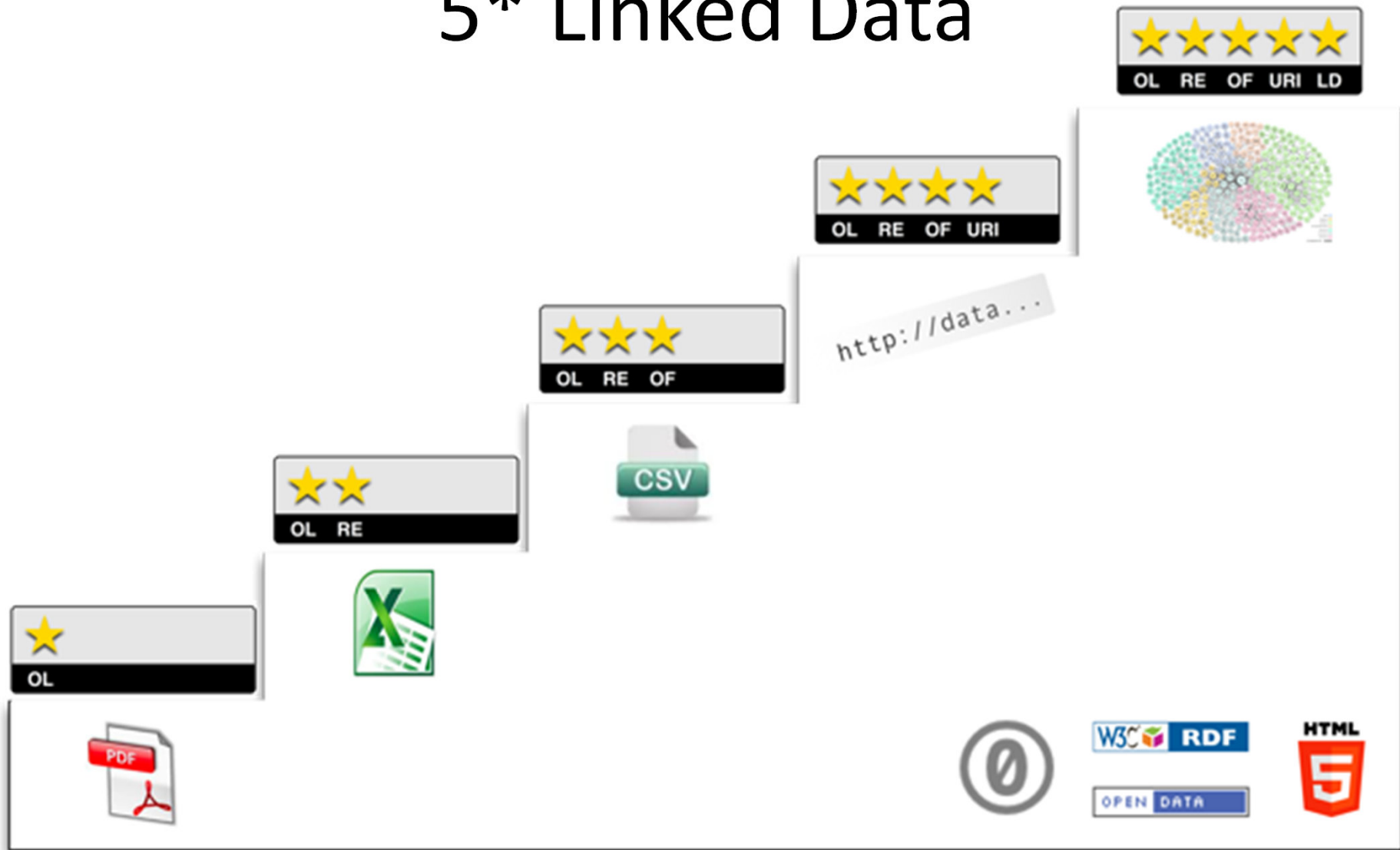
Weaving the Web (1999)

<http://www.w3.org/DesignIssues/LinkedData.html>

Linked Data: Principles

- Use URIs to name / identify “things”
 - <http://linked.rvdata.us/resource/device/100013>
- Do something useful with them
 - Resolve the URIs when navigating to them
- Supply them in a standard format
 - RDF
 - <subject><predicate><object>
 - <Ocean><has-colour><Blue>
- Link to other information objects
 - <http://vocab.nerc.ac.uk/collection/L05/current/133/>

5* Linked Data



Querying Linked Data

- SPARQL

```
PREFIX skos:<http://www.w3.org/2004/02/skos/core#>
select ?portName ?os where
{?uri ?extMap ?os.
?uri skos:prefLabel ?portName
filter contains(str(?os), 'ordnancesurvey')}
order by ?portName
```

portName	os
"Aberdeen" @en	<http://data.ordnancesurvey.co.uk/doc/50kGazetteer/499>
"Aberdovey" @en	<http://data.ordnancesurvey.co.uk/doc/50kGazetteer/518>
"Aberystwyth" @en	<http://data.ordnancesurvey.co.uk/doc/50kGazetteer/662>
"Aldeburgh" @en	<http://data.ordnancesurvey.co.uk/doc/50kGazetteer/3010>
"Amble" @en	<http://data.ordnancesurvey.co.uk/doc/50kGazetteer/6755>
"Amlwch" @en	<http://data.ordnancesurvey.co.uk/doc/50kGazetteer/6832>
"Annan" @en	<http://data.ordnancesurvey.co.uk/doc/50kGazetteer/7608>
"Anstruther" @en	<http://data.ordnancesurvey.co.uk/doc/50kGazetteer/7733>

5* Linked Data Examples

- NERC Vocabulary Server
 - <http://vocab.nerc.ac.uk>
 - Contains vocabulary terms for (meta)data markup
 - SeaDataNEt, EMODnet, Geo-Seas, CF,...
 - Uses the simplest RDF patterns
 - “Glue” in our Linked Data Network

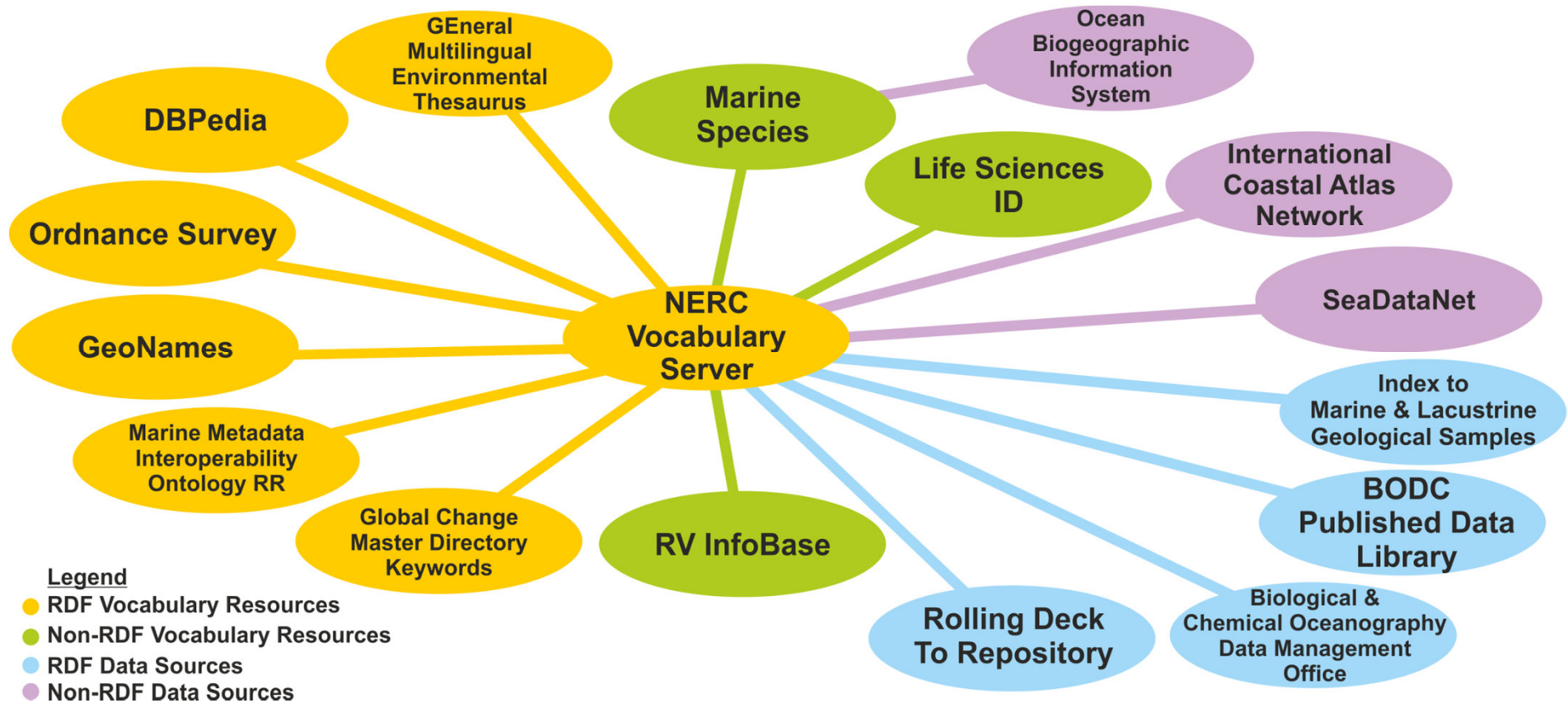
5* Linked Data Examples

- NERC Vocabulary Server
- Rolling Deck-to-Repository (R2R)
 - <http://linked.rvdata.us>
 - Contains information on all research cruises in R2R
 - Links to NVS on device

5* Linked Data Examples

- NERC Vocabulary Server
- Rolling Deck-to-Repository (R2R)
- BCO-DMO
 - <http://linked.bco-dmo.org>
 - Programmes, projects, deployments, datasets, instruments, parameters, people...
 - Uses NVS terms / concepts as instances in the Ocean Data Ontology

An “ocean” of Linked Data



<https://github.com/adamm1/LinkedOceanDataCloud>

What can we do with Linked Data?

nvsp	rvi
"anemometers" @en	"Gill WindObserver II anemometer on Oceanus (bow)"
"anemometers" @en	"RM Young 5103 anemometer on Cape Hatteras (port)"
"anemometers" @en	"RM Young 5103 anemometer on Cape Hatteras (starboard)"
"anemometers" @en	"RM Young 5103 anemometer on Marcus G. Langseth"
"anemometers" @en	"RM Young 5103 anemometer on Wecoma (mainmastport)"
"anemometers" @en	"RM Young 5103 anemometer on Wecoma (mainmaststarboard)"
"bathythermographs" @en	"Sippican MK12 expendableprobe on Atlantis"
"bathythermographs" @en	"Sippican MK12 expendableprobe on Cape Hatteras"
"bathythermographs" @en	"Sippican MK12 expendableprobe on New Horizon"
"bathythermographs" @en	"Sippican MK12 expendableprobe on Point Sur"
"bathythermographs" @en	"Sippican MK12 expendableprobe on Robert Gordon Sproul"
"bathythermographs" @en	"Sippican MK21 expendableprobe on Endeavor"
"bathythermographs" @en	"Sippican MK21 expendableprobe on Healy"
"bathythermographs" @en	"Sippican MK21 expendableprobe on Hugh R. Sharp"
"bathythermographs" @en	"Sippican MK21 expendableprobe on Kilo Moana"
"bathythermographs" @en	"Sippican MK21 expendableprobe on Knorr"
"bathythermographs" @en	"Sippican MK21 expendableprobe on Marcus G. Langseth"
"bathythermographs" @en	"Sippican MK21 expendableprobe on Melville"
"bathythermographs" @en	"Sippican MK21 expendableprobe on Pelican"
"bathythermographs" @en	"Sippican MK21 expendableprobe on Roger Revelle"
"bathythermographs" @en	"Sippican MK21 expendableprobe on Thomas G. Thompson"
"bathythermographs" @en	"Sippican MK21 expendableprobe on Wecoma"
"bathythermographs" @en	"Turo Quoll expendableprobe on Roger Revelle"
"CTD" @en	"Sea-Bird SBE-19 ctd on Marcus G. Langseth"
"CTD" @en	"Sea-Bird SBE-19 ctd on Pelican"

<http://adamml.github.io/nvs-sparql/>

What can we do with Linked Data?

SPARQLer Query Results

a	d
<http://escience.rpi.edu/ontology/BCO-DMO/bcodmo/3/0/Parameter_3>	"Pressure (spatial co-ordinate) exerted by the water body by profiling pressure sensor and corrected to read zero at sea level" @en
<http://escience.rpi.edu/ontology/BCO-DMO/bcodmo/3/0/Parameter_210>	"Potential temperature of the water body by computation using UNESCO 1983 algorithm" @en
<http://escience.rpi.edu/ontology/BCO-DMO/bcodmo/3/0/Parameter_229>	"Practical salinity of the water body by CTD and computation using UNESCO 1983 algorithm" @en
<http://escience.rpi.edu/ontology/BCO-DMO/bcodmo/3/0/Parameter_245>	"Sigma-theta of the water body by CTD and computation from salinity and potential temperature using UNESCO algorithm" @en
<http://escience.rpi.edu/ontology/BCO-DMO/bcodmo/3/0/Parameter_336>	"Year since birth of Christ" @en
<http://escience.rpi.edu/ontology/BCO-DMO/bcodmo/3/0/Parameter_37>	"Concentration of chlorophyll-a {chl-a} per unit volume of the water body [particulate >GF/F phase] by filtration, acetone extraction and high performance liquid chromatography (HPLC)" @en
<http://escience.rpi.edu/ontology/BCO-DMO/bcodmo/3/0/Parameter_175>	"Concentration of ammonium {NH4} per unit volume of the water body [unknown phase] by colorimetric autoanalysis" @en
<http://escience.rpi.edu/ontology/BCO-DMO/bcodmo/3/0/Parameter_5>	"Sigma-T of the water body by computation from salinity and temperature using UNESCO algorithm" @en
<http://escience.rpi.edu/ontology/BCO-DMO/bcodmo/3/0/Parameter_18>	"Attenuance (unspecified wavelength) per unit length of the water body by transmissometer" @en
<http://escience.rpi.edu/ontology/BCO-DMO/bcodmo/3/0/Parameter_50>	"Electrical conductivity of the water column" @en
<http://escience.rpi.edu/ontology/BCO-DMO/bcodmo/3/0/Parameter_52>	"Electrical conductivity of the water column" @en
<http://escience.rpi.edu/ontology/BCO-DMO/bcodmo/3/0/Parameter_141>	"Latitude north" @en

<http://adamml.github.io/nvs-sparql/>

What can we do with Linked Data?

SPARQLer Query Results

d	rvl	a
"CTD" @en	"Sea-Bird SBE-911plus ctd on Pelican"	<http://escience.rpi.edu/ontology/BCO-DMO/bcodmo/3/0/Instrument_18>
"CTD" @en	"Sea-Bird SBE-911plus ctd on Oceanus"	<http://escience.rpi.edu/ontology/BCO-DMO/bcodmo/3/0/Instrument_18>
"CTD" @en	"Sea-Bird SBE-911plus ctd on Thomas G. Thompson"	<http://escience.rpi.edu/ontology/BCO-DMO/bcodmo/3/0/Instrument_18>
"CTD" @en	"Sea-Bird SBE-911plus ctd on F.G. Walton Smith"	<http://escience.rpi.edu/ontology/BCO-DMO/bcodmo/3/0/Instrument_18>
"CTD" @en	"Sea-Bird SBE-911plus ctd on Roger Revelle"	<http://escience.rpi.edu/ontology/BCO-DMO/bcodmo/3/0/Instrument_18>
"CTD" @en	"Sea-Bird SBE-911plus ctd on Robert Gordon Sproul"	<http://escience.rpi.edu/ontology/BCO-DMO/bcodmo/3/0/Instrument_18>
"CTD" @en	"Sea-Bird SBE-911plus ctd on Point Sur"	<http://escience.rpi.edu/ontology/BCO-DMO/bcodmo/3/0/Instrument_18>
"CTD" @en	"Sea-Bird SBE-25 ctd on Savannah"	<http://escience.rpi.edu/ontology/BCO-DMO/bcodmo/3/0/Instrument_18>
"CTD" @en	"Sea-Bird SBE-911plus ctd on Blue Heron"	<http://escience.rpi.edu/ontology/BCO-DMO/bcodmo/3/0/Instrument_18>
"CTD" @en	"Sea-Bird SBE-911plus ctd on Cape Hatteras"	<http://escience.rpi.edu/ontology/BCO-DMO/bcodmo/3/0/Instrument_18>
"CTD" @en	"Sea-Bird SBE-911plus ctd on Hugh R. Sharp"	<http://escience.rpi.edu/ontology/BCO-DMO/bcodmo/3/0/Instrument_18>
"CTD" @en	"Sea-Bird SBE-911plus ctd on Endeavor"	<http://escience.rpi.edu/ontology/BCO-DMO/bcodmo/3/0/Instrument_18>

<http://adamml.github.io/nvs-sparql/>

What might we do with Linked Data?

- Potential to answer cross-disciplinary questions
 - Track a pollutant from source-to-sea
 - Requires common vocabularies for
 - Geographic location
 - Chemical
 - Work being developed by BODC & CEH in the UK
 - Using
 - Ordnance Survey Linked Data
 - CAS numbers
- Or connect data with broadcast programming
 - BBC website is entirely Linked Data driven...

What might we do with Linked Data?

BBC Sign in News Sport Weather iPlayer TV Radio More... Search

one The Blue Planet


Home Episodes Clips

Open Ocean > Last on

Episode 3 of 8
DURATION: 1 HOUR
This programme focuses on the predatory skills of some of the most charismatic hunters found on the planet: whales, dolphins, tuna, shark and rapier-nosed billfish. The open ocean is unimaginably immense - it covers more than 360 million square kilometres of the Earth's surface. Much of this... > SHOW MORE

Share Facebook Twitter YouTube

Clips



http://www.bbc.co.uk/programmes/b0080pjz

Go Validate RDF -

About this browser - SIOC Data Sources

http://purl.org/ontology/po/:Episode

http://purl.org/ontology/po/:pid
b0080pjz
dc:title
Open Ocean

http://purl.org/ontology/po/:short_synopsis
Looking at predatory skills of whales, dolphins, tuna, shark and rapier-nosed billfish.

http://purl.org/ontology/po/:medium_synopsis
David Attenborough narrates a natural history of the oceans. This programme focuses on the predatory skills of whales, dolphins, tuna, shark and rapier-nosed billfish.

http://purl.org/ontology/po/:long_synopsis
This programme focuses on the predatory skills of some of the most charismatic hunters found on the planet: whales, dolphins, tuna, shark and rapier-nosed billfish. The open ocean is unimaginably immense - it covers more than 360 million square kilometres of the Earth's surface. Much of this huge expanse of seawater is marine desert with virtually no sign of life. Yet the fastest and most voracious predators chart how they track down prey in the open ocean from a minute egg to a 200 kilogram shark.

http://purl.org/ontology/po/:masterbrand

http://www.bbc.co.uk/bbccone#servi

http://purl.org/ontology/po/:position
3

http://purl.org/ontology/po/:genre

http://www.bbc.co.uk/programmes/

http://purl.org/ontology/po/:genre

http://www.bbc.co.uk/programmes/

Cart: 0 Dataset(s) Proceed to check out Reset Basket

Export Store query

Reset all steps > Biological oceanography > Biota abundance, biomass and diversity > Fish

SEARCH BY:

Geographical Box

Time period

Measuring area type
point (103)

Parameter categories
Fisheries (103)

Disciplines
Fisheries and aquaculture (103)

Add to basket 20 50 100 Records Go

#	Data set name	Variables measured	Instrument / gear type
<input type="checkbox"/>	CTD_T200806F8 data set	Biological oceanography > Fish > Biota abundance, biomass and diversity Fisheries and aquaculture > Fisheries > Fish	CTD
<input type="checkbox"/>	CTD_T200806C18 data set	Biological oceanography > Fish > Biota abundance, biomass and diversity Fisheries and aquaculture > Fisheries > Fish	CTD

Benefits of Linked Data

- Loose integration
 - Data presented not in standardised systems
 - Common link in chain is NVS
 - But a common link is required somewhere in (meta)data
 - “Small pieces, loosely joined”
- Federated querying
 - Common access point to query multiple nodes
 - No mirroring / caching required
- Allows standard tools to be deployed

Benefits of Linked Data

SISSVoc Powered by ELDA

NATURAL ENVIRONMENT RESEARCH COUNCIL NERC-SISSVoc Test

Marismas / Saltmarshes

<http://vocab.nerc.ac.uk/collection/R04/current/Saltmarshes/>

alt label	Salt Marshes
broader	Habitat_Alteration Natural_Processes NaturalCoastalFeatures
broader transitive	Habitat_Alteration Natural_Processes NaturalCoastalFeatures
date	2012-06-27 12:15:46.0
deprecated	false
identifier	SDN:A04::Saltmarshes
in scheme	current current
notation	SDN:A04::Saltmarshes
note	accepted
skos_definition	Marismas en las que el agua es salina. Estas se producen sobre todo en los humedales costeros, que tienen vegetación halófila y son regularmente inundados durante la marea alta. Los pantanos costeros de sal pueden ayudar a conservar el litoral y disipar tanto la fuerza de las mareas como el posible

json | rdf | text | ttl | xml

R2R Eventlogger Instruments: Community Vocabularies

View Edit Mapped Terms Unmapped Terms Associated Vocabularies Reports

Vocabulary	Source
SeaDataNet Device Catalog	http://vocab.nerc.ac.uk/collection/L05/current/
Geo-Seas Seismic Receiver Types	http://vocab.nerc.ac.uk/collection/GSB/current/
Global Change Master Directory Instrument Keywords	http://vocab.nerc.ac.uk/collection/P10/current/

SPARQL Browse: <http://vocab.nerc.ac.uk/collection/L05/current/POS16/>

View Edit SPARQL Browser Reports

Property	Value
rdf:type	http://www.w3.org/2004/02/skos/core#Concept
skos:prefLabel	Argos GPS-localised transmitters
skos:altLabel	Argos GPS
dcterms:date	2010-02-19 11:52:56.0
owl:versionInfo	1
dcterms:identifier	SDN:L05:POS16

R2R Eventlogger Instruments: Unmapped Terms

View Edit Mapped Terms Unmapped Terms Associated Vocabularies Reports

Unmapped Term
Academic Research Vessel (view edit)
MOCNESS1 (view edit)
MOCNESS10 (view edit)
PCO2 r2r_devtype (view edit)
Sediment Trap (view edit)
Sediment Trap - Moored (view edit)

Thank you

- <http://vocab.nerc.ac.uk>
- <http://linked.rvdata.us>
- <http://linked.bco-dmo.org>
- <https://github.com/adamm1/LinkedOceanDataCloud>
- Journal of Ocean Technology 8(3) – Sept 2013

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