



National Oceanography Centre
British Oceanographic Data
Centre BODC

Semantic interoperability of operational parameter terminologies in marine sciences

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Introduction

- A number of parameter labelling schemes have been used for decades in marine sciences to harmonise variable names in files and databases
- Examples from SeaDataNet, Climate and Forecast, and ICES
- Parameter labelling schemes are hard to align!
- Rules of semantic interoperability can help
- Related development work
 - Research Data Alliance's I-ADOPT WG Interoperability Framework
 - ENVRI-FAIR EOVI demonstrator

We need access to data – example GOOS EOVs



Oxygen?

“Oxygen”: Element? Molecule? Concentration?
Saturation? Production? Respiration? Presumably in
the ocean, right?



Oxygen?

GOOS-Panel-Biogeochemistry-01-EOV-Oxygen

EOV Specification Sheet: Oxygen

Author(s)	IOCCP
Summary	version 2.0 (Aug 2017)
Doc Type	Reference Document
Status	Published on 28/08/17
Notes	For more information on the Biogeochemistry EO\
This document is in the list(s):	GOOS-EOV-SpecificationSheets [view list]

Oxygen... ...the EOVS



Table 1: EOVS Information	
Name of EOVS	Oxygen
Sub-Variabes	Dissolved Oxygen (O ₂)
Derived Products	Apparent Oxygen Utilization, Air-sea O ₂ fluxes, Net Community Production (NCP), Net carbon export flux, Ocean oxygen inventories
Supporting Variables	Surface and subsurface temperature, Surface and subsurface salinity, Ocean surface vector stress (wind speed)

Table 3: Current Observing Networks						
Observing Approach	Profiling Floats	Ship-based Repeat Hydrography	Moored Fixed-point Observatories	Gliders	Ship-based Fixed-point Observatories	Ship-based Underway Observations
Readiness Level of the Observing Approach for this EOVS	Mature	Mature	Mature	Mature	Mature	Mature
Leading Observing Network	Biogeochemical (BGC)-Argo	GO-SHIP	OceanSITES	OceanGliders		
Sensor(s)/Technique	Optical oxygen sensor	Wet chemistry (Winkler)/Polarographic	Optical oxygen sensor	Optical oxygen sensor/Polarographic	Wet chemistry (Winkler)/Polarographic	Optical oxygen sensor
Accuracy/Uncertainty Estimate (units)	±2.0 μmol O ₂ kg ⁻¹	±0.5 μmol O ₂ kg ⁻¹	±2.0 μmol O ₂ kg ⁻¹	±2.0 μmol O ₂ kg ⁻¹	±0.5 μmol O ₂ kg ⁻¹	±2.0 μmol O ₂ kg ⁻¹

So we've established that the EOV "Oxygen" is the amount of oxygen dissolved in a unit volume or a unit mass of sea water

How to find the data?



Most data repositories use parameter labelling schemes to harmonise their data holdings

Parameter labelling schemes – 3 examples



See: <https://cfconventions.org/Data/cf-standard-names/docs/guidelines.html>

CF
Standard
Names

P07 - Climate and Forecast Standard Names

`mole_concentration_of_dissolved_molecular_oxygen_in_sea_water`

CF14N29

Mole concentration means number of moles per unit volume, also called "molarity", and is used in the construction `mole_concentration_of_X_in_Y`, where X is a material constituent of Y. A chemical or biological species denoted by X may be described by a single term such as "nitrogen" or a phrase such as "nox_expressed_as_nitrogen". The chemical formula for molecular oxygen is O₂.



See: <https://github.com/nvs-vocabs/P01>

BODC P01
Vocabulary
collection
(PUV)

P01 - BODC Parameter Usage Vocabulary

Concentration of oxygen {O₂ CAS 7782-44-7} per unit volume of the water body [dissolved plus reactive particulate phase]

DOXYZXX

WC_dissO₂

Concentration of dissolved oxygen per unit volume of the water column. Oxygen may be expressed in terms of mass, volume or quantity of substance.



See: <https://www.ices.dk/data/vocabularies/Pages/default.aspx>

ICES
PARAM
collection

Code:	DOXY
Description:	dissolved oxygen
Long Description:	
CodeType:	<u>PARAM</u> - Parameters
Deprecated:	False
Created Date:	2006-10-23
Modified Date:	2006-10-23
Link to this Code:	//vocab.ices.dk/?CodeID=33506

Dissolved oxygen in CF standard name, BODC PUV, and ICES PARAM - a selection

CF
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P07 - Climate and Forecast Standard Names

mole_concentration_of_dissolved_molecular_oxygen_in_sea_water

CF14N29

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BODC P01
Vocabulary
collection
(PUV)

P01 - BODC Parameter Usage Vocabulary

Concentration of oxygen {O2 CAS 7782-44-7} per unit volume of the water body [dissolved plus reactive particulate phase]

DOXYZZXX

WC_dissO2

Concentration of dissolved oxygen per unit volume of the water column. Oxygen may be expressed in terms of mass, volume or quantity of substance.

ICES
PARAM
collection

Code: DOXY
Description: dissolved oxygen
Long Description:
CodeType: [PARAM](#) - Parameters
Deprecated: False
Created Date: 2006-10-23
Modified Date: 2006-10-23
Link to this Code: [//vocab.ices.dk/?CodeID=33506](http://vocab.ices.dk/?CodeID=33506)

Are
they the
same?



Common framework to achieve semantic interoperability (RDA I-ADOPT WG)

P07 - Climate and Forecast Standard Names

mole_concentration_of_dissolved_molecular_oxygen_in_sea_water

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Deprecated: False

Created Date: 2006-10-23

Modified Date: 2006-10-23

Link to this Code: [//vocab.ices.dk/?CodeID=33506](http://vocab.ices.dk/?CodeID=33506)

1
2
3



The quantity measured is "Concentration"



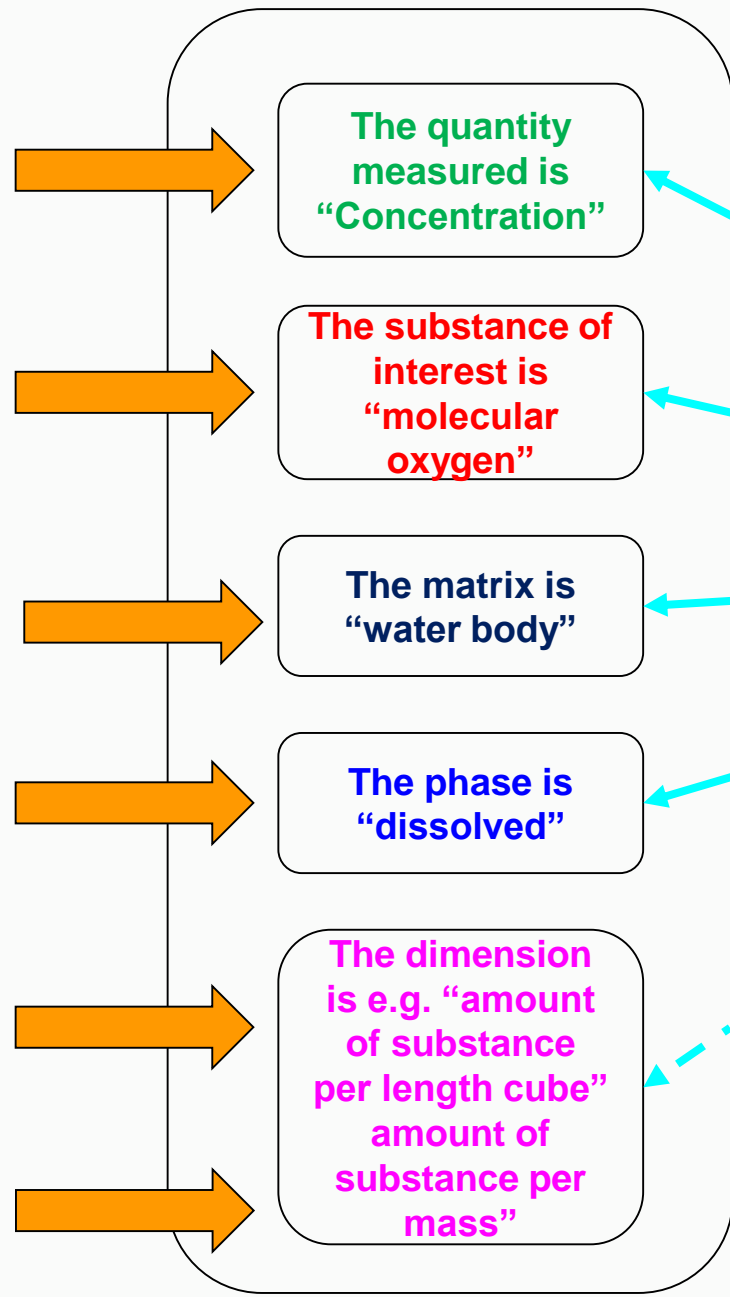
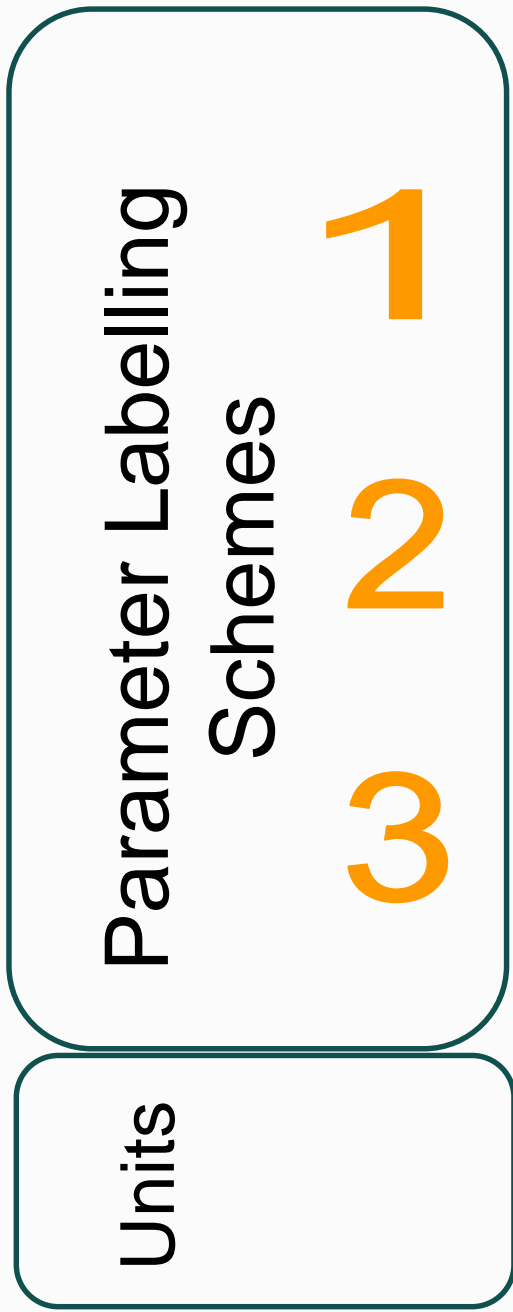
The substance of interest is "molecular oxygen"



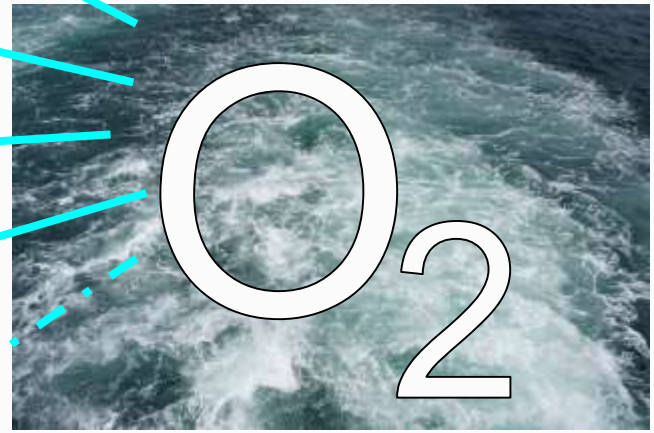
The matrix is "water body"



The phase is "dissolved"



Interoperability Framework with de-referenceable components using a common set of interlinked "FAIR" terminologies and ontologies (see RDA I-ADOPT WG)



EOV Concept "Oxygen"

How to find the data across distributed systems?

=> Need to translate the GOOS specifications into a set of machine actionable rules based on harmonised semantic information that can be matched to parameter labelling schemes

How it could work

Example: ENVRI-FAIR Marine Domain EOY Demonstrator



User requests EOY "Oxygen"

EOV parameter

RULES

Sparql query with rules

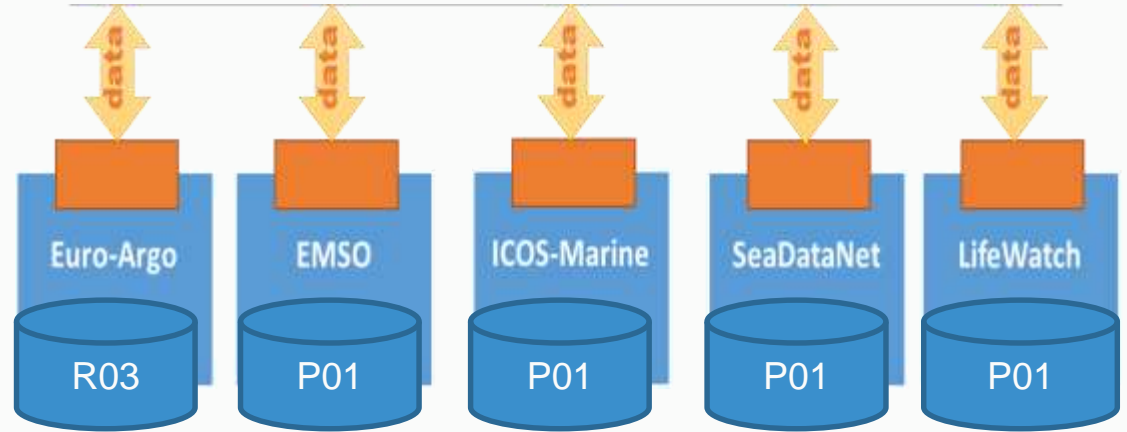
NVS

Result

List of parameter codes

RI query engine

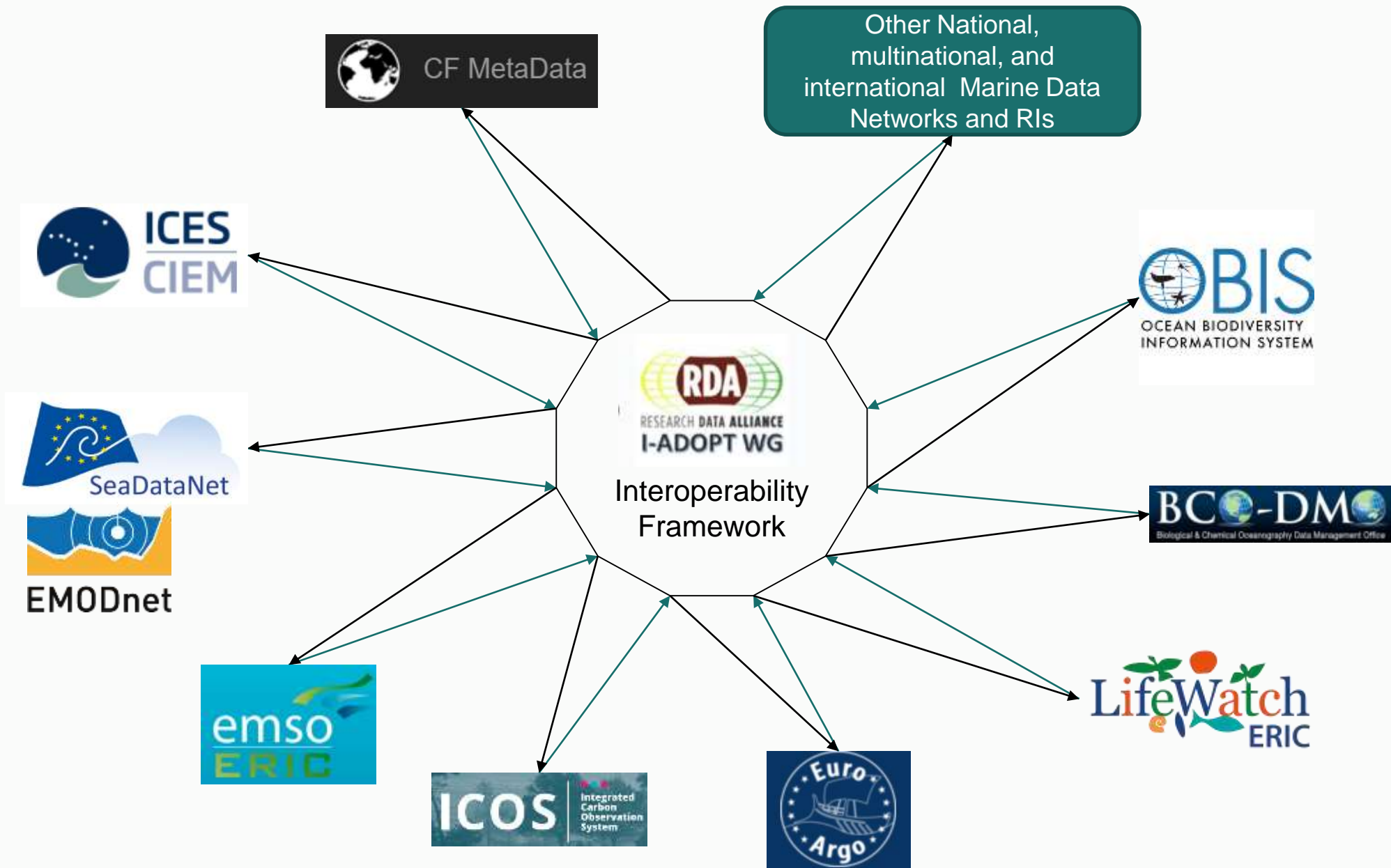
ERDDAP ERDDAP ERDDAP ERDDAP ERDDAP



```

Query x
1 > prefix skos:<http://www.w3.org/2004/02/skos/core#> prefix rdf:<http://www.w3.org/1999/02/22-rdf-syntax-ns#> prefix owl:<http://www.w3.org/2002/07/owl#> prefix dc:<http://purl.org/dc/terms/>
2 select * where
3 {<http://vocab.nerc.ac.uk/collection/P01/current/> skos:member ?dt . optional{?dt skos:definition ?def .
4 FILTER(lang(matches(lang(?def), "en")))} . ?dt skos:prefLabel ?pl ;
5 skos:broader ?k ;
6 skos:broader ?m ;
7 skos:broader ?n .
8 FILTER (regex(str(?k),"S06/current/S0600045/", "i") ) .
9 FILTER (regex(str(?m),"S27/current/C5002779/", "i") ) .
10 FILTER (regex(str(?n),"S26/current/MAT00633/", "i") )
11 }
12 }
    
```

Table Response 26 results in 5.582 seconds Filter query results Page size: 50





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Thank you

For more info about the RDA I-ADOPT WG:

<https://www.rd-alliance.org/group/interoperable-descriptions-observable-property-terminology-wg-i-adopt-wg/wiki/i-adopt-0>

Or join one of our sessions at the RDA P17 Plenary next week:

21 April 2021, 15:00 – 16:30 UTC

23 April 2021, 07:00 – 08:30 UTC