Outline

- What is Darwin Core (DwC)?
- What is MarineTLO?
- Mappings between DwC and MarineTLO
  - Classes
  - Properties
- Examples of modeling using MarineTLO and DwC
  - Scientific Name Assignment
  - Rights
  - Predators and Competitors
- Conclusion
What is Darwin Core?

Darwin Core is a *glossary of terms* intended to facilitate the sharing of information about biological diversity.

- It was originally conceived to facilitate the discovery, retrieval, and integration of information about modern biological specimens, their spatiotemporal occurrence, and their supporting evidence housed in collections (physical or digital).

- The Darwin Core is based on the standards developed by the *Dublin Core Metadata Initiative* and should be viewed as an extension of the Dublin Core for biodiversity information.
What is MarineTLO?

- MarineTLO is a **top-level ontology** for the marine domain (also applicable to the terrestrial domain)
  - To tackle the need for having integrated sets of facts about marine species, and thus to assist research about species and biodiversity.
  - It provides a unified and coherent core model for schema mapping which enables formulating and answering queries which cannot be answered by any individual source.
Figure 1. The different degrees of formalization: from unstructured textual content to ontology and logical rules.

Figure taken from: “From Glossaries to Ontologies: Extracting Semantic Structure from Textual Definitions”, Roberto NAVIGLI and Paola VELARDI
## Example of DwC2MarineTLO mappings

<table>
<thead>
<tr>
<th>DwC Term</th>
<th>Mapping Operator</th>
<th>MarineTLO Class/Property</th>
</tr>
</thead>
<tbody>
<tr>
<td>dwc: Event</td>
<td>Sub Class Of</td>
<td>core: BC4 Temporal Phenomenon</td>
</tr>
<tr>
<td>dwc: Identification</td>
<td>CbTi</td>
<td>core: BC44 Attribute Assignment</td>
</tr>
<tr>
<td>(the assignment of a scientific name)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>dwc: MeasurementOrFact</td>
<td>CbTi</td>
<td>core: BC54 Measurement</td>
</tr>
<tr>
<td>dwc: measurementType</td>
<td>CbTi</td>
<td>core: BC54 Measurement</td>
</tr>
<tr>
<td></td>
<td></td>
<td>core: BC5 Dimension</td>
</tr>
<tr>
<td>dwc: measurementValue</td>
<td>CbTi</td>
<td>String Number</td>
</tr>
<tr>
<td>dwc: measurementUnit</td>
<td>Equivalent To</td>
<td>core: BC55 Measurement Unit</td>
</tr>
<tr>
<td>dcterms:type</td>
<td>Sub Property Of</td>
<td>core: LX3 has type</td>
</tr>
<tr>
<td>dwc: measurementDeterminedDate</td>
<td>Sub Property Of</td>
<td>core: LC5 has time span</td>
</tr>
<tr>
<td>Dwc:measurementDeterminedBy</td>
<td>Sub Property Of</td>
<td>core:LC13 is carried out by</td>
</tr>
</tbody>
</table>

**CbTi**: Can be Transformed Into

An extended mapping can be found at:  
Using DwC

<table>
<thead>
<tr>
<th>scientificNameID</th>
<th>urn:lsid:zoobank.org:act:9CEE8F90-9596-49F6-AA22-BB79C0E816D9</th>
</tr>
</thead>
<tbody>
<tr>
<td>scientificName</td>
<td>Sphaerosyllis levantina</td>
</tr>
<tr>
<td>scientificNameAuthorship</td>
<td>Faulwetter, Chatzigeorgiou, Galil, Nicolaidou &amp; Arvanitidis, 2011</td>
</tr>
</tbody>
</table>

Issues

- Select all the scientific names that were assigned in the 19th century
- The authorship given as string prevent us to further explore/navigate on it (highly required in LOD)

Using MarineTLO (Type Creation)
Using DwC

Using a real occurrence dataset:

<table>
<thead>
<tr>
<th>datasetID</th>
<th>d50024ac-5268-477e-8559-933779553b34</th>
</tr>
</thead>
<tbody>
<tr>
<td>datasetName</td>
<td>EasternMedSyllids</td>
</tr>
<tr>
<td>rights</td>
<td><a href="http://creativecommons.org/licenses/by/3.0/">http://creativecommons.org/licenses/by/3.0/</a></td>
</tr>
<tr>
<td>rightsHolder</td>
<td>Israel Oceanographic &amp; Limnological Research Ltd</td>
</tr>
</tbody>
</table>

DwC scope note:

Information about rights held in and over the resource. Typically, rights information includes a statement about various property rights associated with the resource, including intellectual property rights.

Issue: Does the rights refer to the occurrence records or to the dataset?
Using MarineTLO

- BC23 Organization
  - Israel Oceanographic & Limnological Research Ltd

  E30 Rights
  - http://creativecommons.org/licenses/by/3.0

  BC14 Dataset
  - d50024ac-5268-477e-8559-933779553b34

  refers_to

  BC28 Observation
Problem Statement

- How to express associations such as
  - The species X is predator of the species Y
  - The species Y is prey of the species X

- e.g. *Thunnus Albacares* is predator of *Katsuwonus Pelamis*
Biological Interaction Between Species 2/5

Using **DwC** *(DwC: Resource Relationship patter)*

<table>
<thead>
<tr>
<th>resourceID</th>
<th><a href="http://www.marinespecies.org/aphia.php?p=taxdetails&amp;id=127027">http://www.marinespecies.org/aphia.php?p=taxdetails&amp;id=127027</a></th>
</tr>
</thead>
<tbody>
<tr>
<td>relationshipofResource</td>
<td>predator of</td>
</tr>
</tbody>
</table>

**Query Formulation:**

```sql
Select ?preys
Where
{
  ?x dwc:relationshipofResource "predator of" .
  ?x dwc:relatedresourceID ?preys
}
```

Using **MarineTLO** *(usually is predator of)*

```
Select ?preys
Where
{
}
```
Using DwC (DwC: Resource Relationship pattern)

<table>
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<tr>
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<th><a href="http://www.marinespecies.org/aphia.php?p=taxdetails&amp;id=127027">http://www.marinespecies.org/aphia.php?p=taxdetails&amp;id=127027</a></th>
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**ISSUE:** Using the above pattern, it becomes even more complex for representing and formulating queries over more complex and structured relationships, such as:

- predatorOf
- hostOf
- preyOf
- Competitor Of
Conclusion

- Comparing MarineTLO (top-level ontology) and Darwin Core (glossary of terms)
  - MarineTLO over performs DwC in representing and query formulation
    - Scientific Name Assignment
    - Rights
    - Predators and Competitors

- As next
  - Extending MarineTLO to cover part of DwC which is currently under investigation.

**NOTE:** This presentation is a first draft showing the outcomes of the ongoing activity on MarineTLO and DwC comparison.