



Do we know the known?
Zooplankton biodiversity of the North Sea

Silke Laakmann, Inga Mohrbeck, Thomas Knebelsberger
and Michael J. Raupach

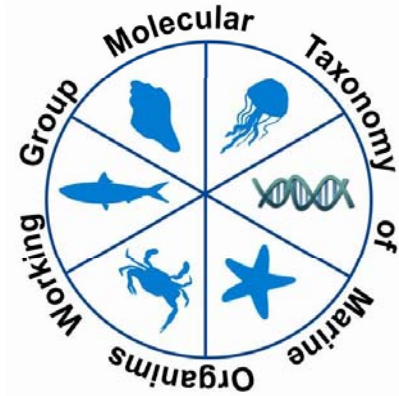
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Sampling

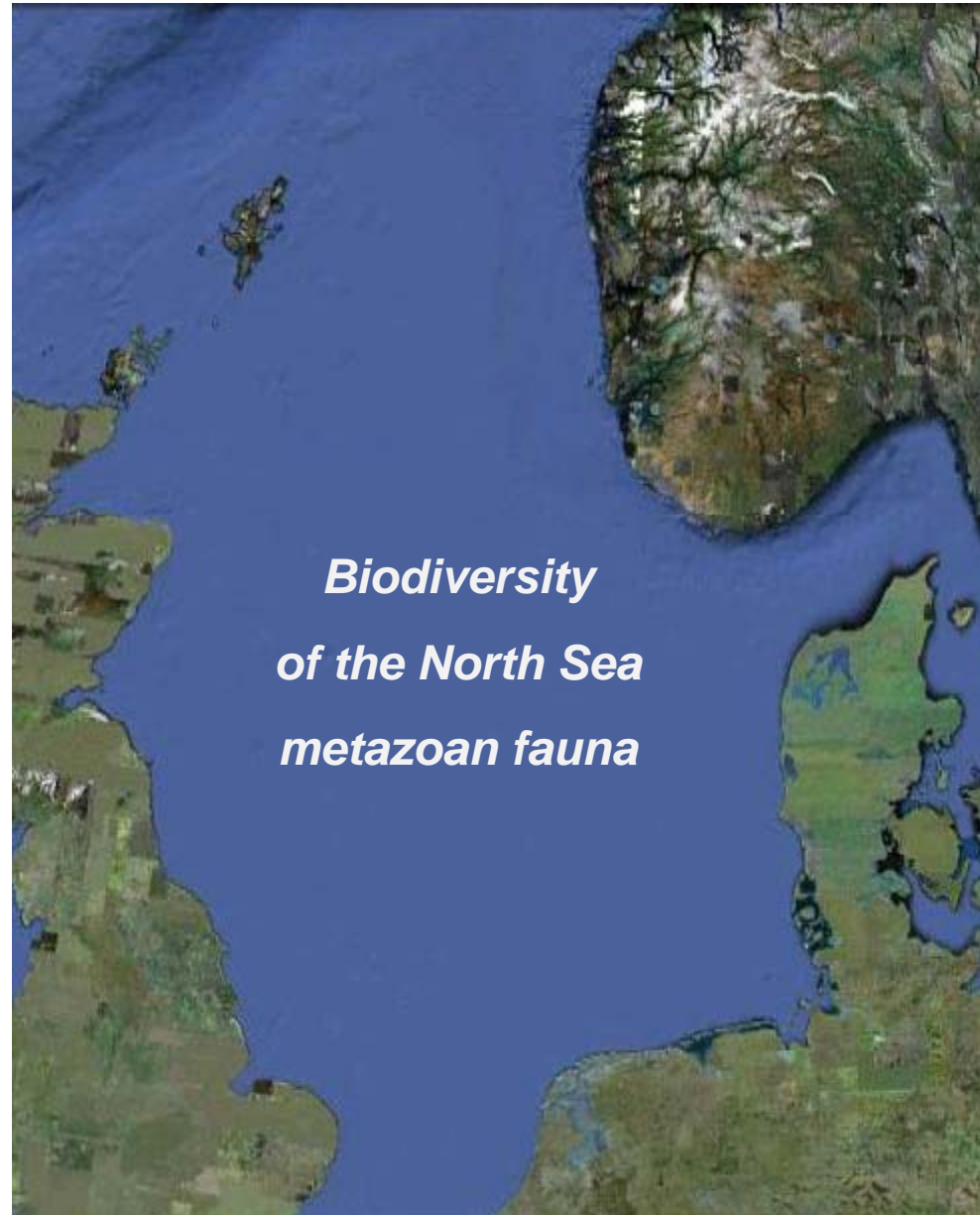
Barcoding

Application



German Centre for
Marine Biodiversity
Research (DZMB)

Senckenberg Institute
Wilhelmshaven
Germany



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Nekton



Epibenthos



Zooplankton



Infauna



*Biodiversity
of the North Sea
metazoan fauna*

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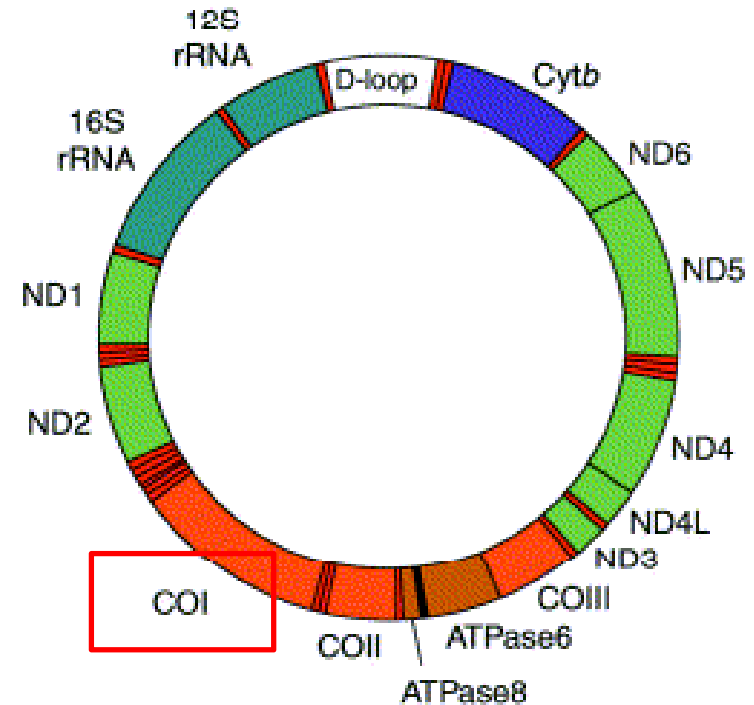
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DNA barcoding

Adding a species-specific DNA sequence to each identified species

Mitochondrial COI (cytochrome c oxidase subunit I) ~ 650 bp fragment



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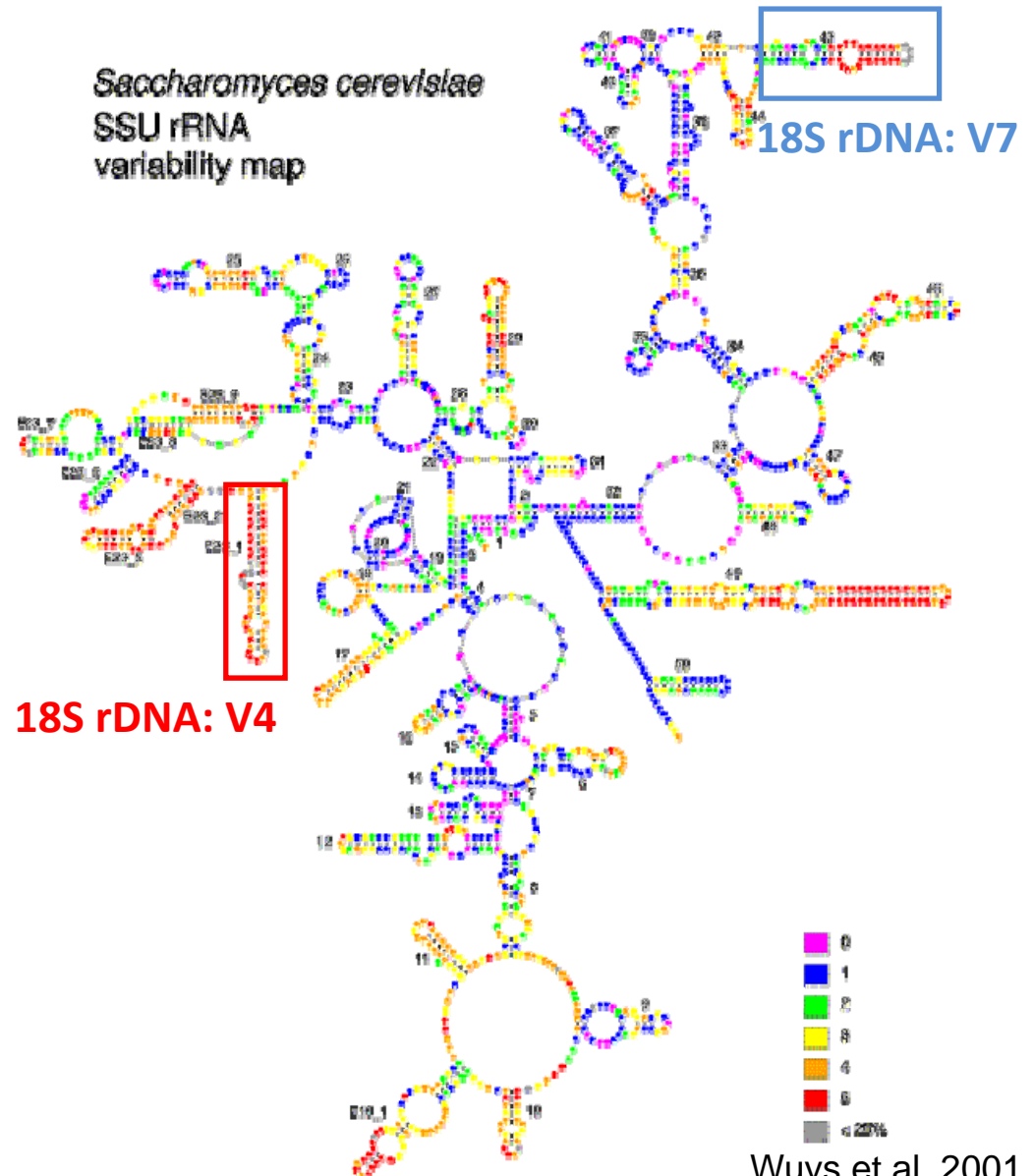
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Nuclear ribosomal 18S

Highly variable ribosomal expansion segments for supplementary species identification



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Biodiversity study



Collection of whole specimens or vouchers



Public Sequence Data bases



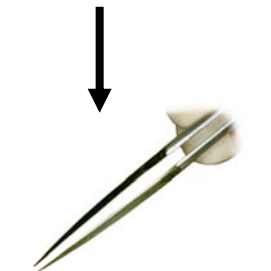
Separation of specimens;
Photographic documentation



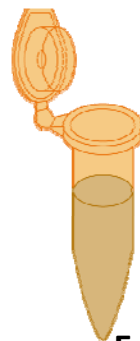
DNA Collection

Species	Gene	Sequence
Dalvat mirabilis	18S rbc	AGCTTAGGCTGTTAACTAGGGGTTACTT...
Isobolites nebuli	18S rbc	AGCTTAGGCTGTTAACTAGGGGTTACTT...
Meonius sp.	KAO-2001 18S	AGCTTAGGCTGTTAACTAGGGGTTACTT...
Moriosomus seticollis	18S	AGCTTAGGCTGTTAACTAGGGGTTACTT...
Primitellus sp.	KAO-2001 18S	AGCTTAGGCTGTTAACTAGGGGTTACTT...
Orthopneustes sp.	KAO-2001 18S	AGCTTAGGCTGTTAACTAGGGGTTACTT...
Strophodromus sp.	KAC	AGCTTAGGCTGTTAACTAGGGGTTACTT...
Sphallomorpha sp.	KAC	AGCTTAGGCTGTTAACTAGGGGTTACTT...
Eriopus nididus	18S small	AGCTTAGGCTGTTAACTAGGGGTTACTT...
Pelecium sp.	nr. sulcipis	AGCTTAGGCTGTTAACTAGGGGTTACTT...
Copelatus chevrolati	ren	AGCTTAGGCTGTTAACTAGGGGTTACTT...
Suchus inflatus	18S rbc	AGCTTAGGCTGTTAACTAGGGGTTACTT...
Systolosoma laterium	18S	AGCTTAGGCTGTTAACTAGGGGTTACTT...
Climidium calcaratum	18S	AGCTTAGGCTGTTAACTAGGGGTTACTT...
Omoichymus hamatus	18S	AGCTTAGGCTGTTAACTAGGGGTTACTT...
Ornus californicus	18S	AGCTTAGGCTGTTAACTAGGGGTTACTT...
Cicindela sedecimpunctata	18S	AGCTTAGGCTGTTAACTAGGGGTTACTT...
Pachyleles strigata	18S	AGCTTAGGCTGTTAACTAGGGGTTACTT...
Arthroporus sp.	KAO-1	AGCTTAGGCTGTTAACTAGGGGTTACTT...
Metrius contractus	18S	AGCTTAGGCTGTTAACTAGGGGTTACTT...
Elaphrus californicus	18S	AGCTTAGGCTGTTAACTAGGGGTTACTT...
Omnichron oblaterium	18S	AGCTTAGGCTGTTAACTAGGGGTTACTT...

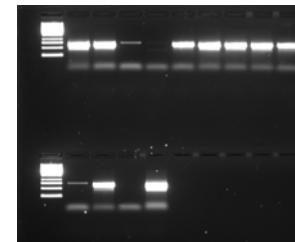
Sequence Data base



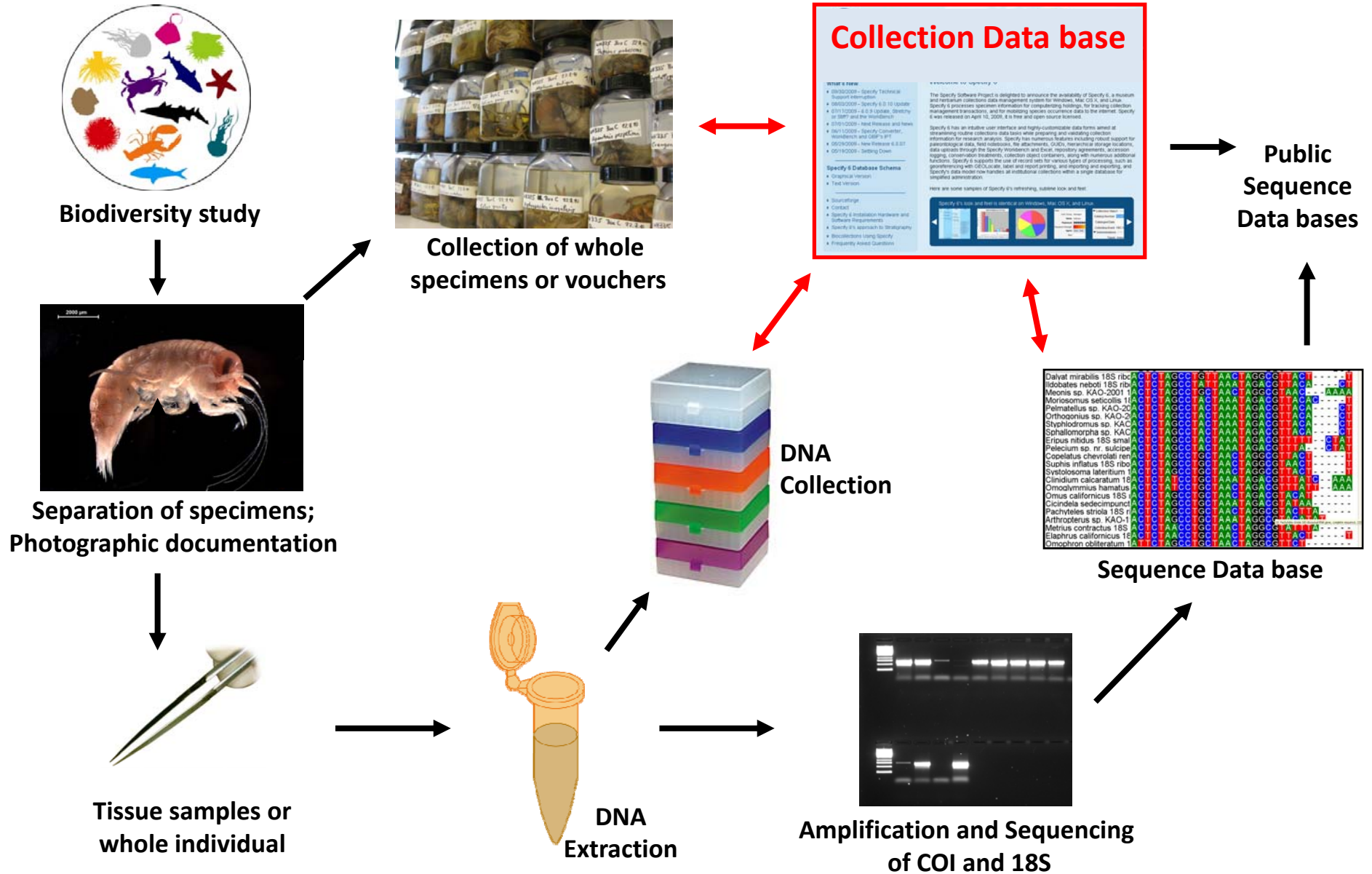
Tissue samples or whole individual



DNA Extraction



Amplification and Sequencing of COI and 18S



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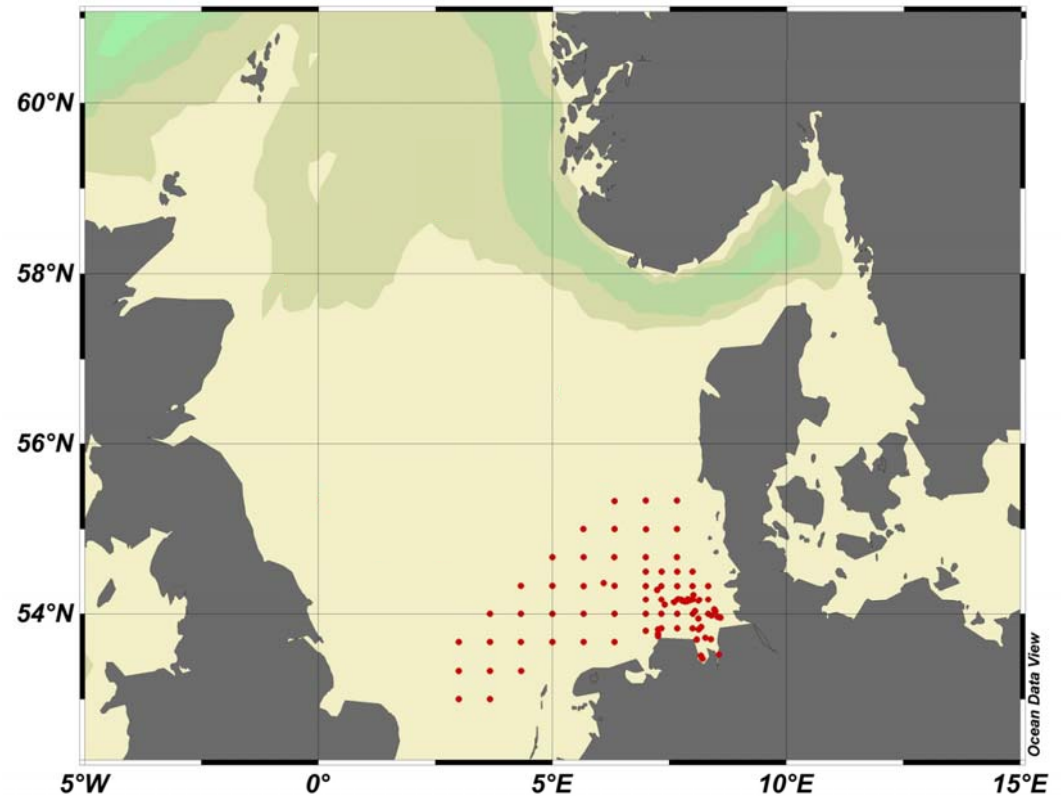


Different fractions:
80, 150, 300 and 500 μm mesh size

Horizontal and vertical hols

Different regions and whole seasonal cycle

Fixation in **absolute ethanol** or **DESS** (solution containing dimethyl sulphoxide, disodium EDTA, and saturated NaCl; Yoder et al. 2006)



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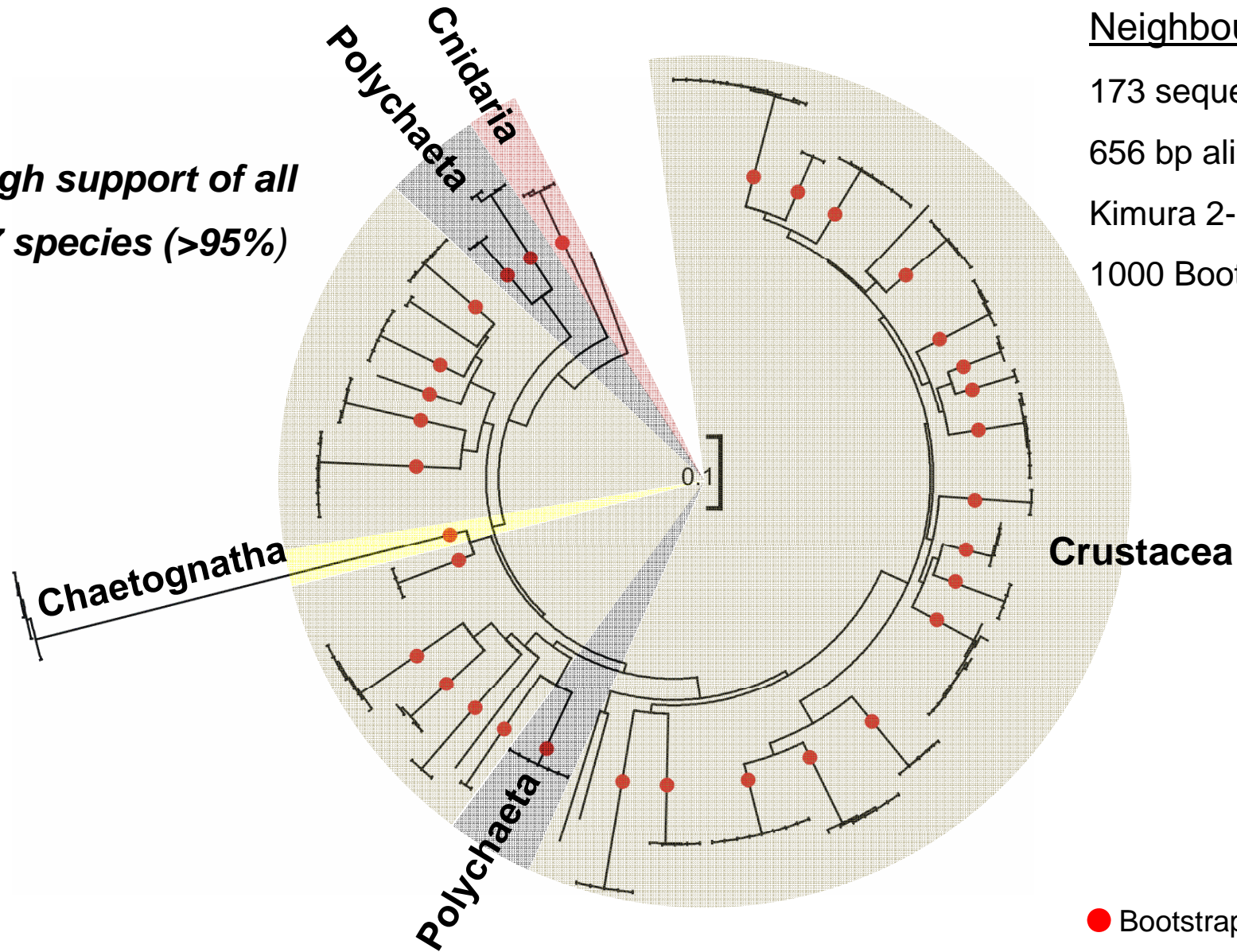
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**High support of all
37 species (>95%)**



Neighbour Joining

173 sequences

656 bp alignment

Kimura 2-parameter

1000 Bootstraps

● Bootstrap value >95%

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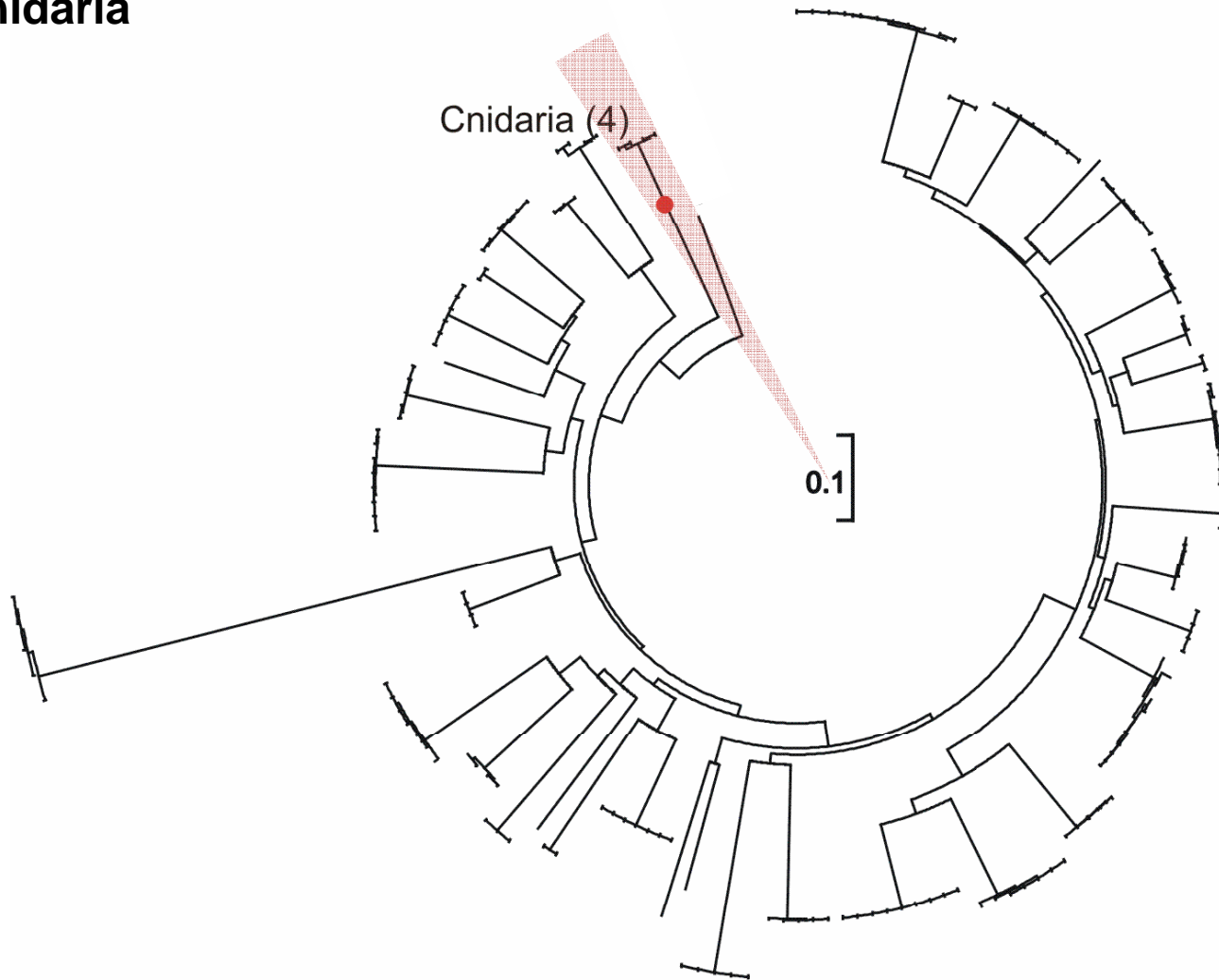
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Cnidaria



● Bootstrap value >95%

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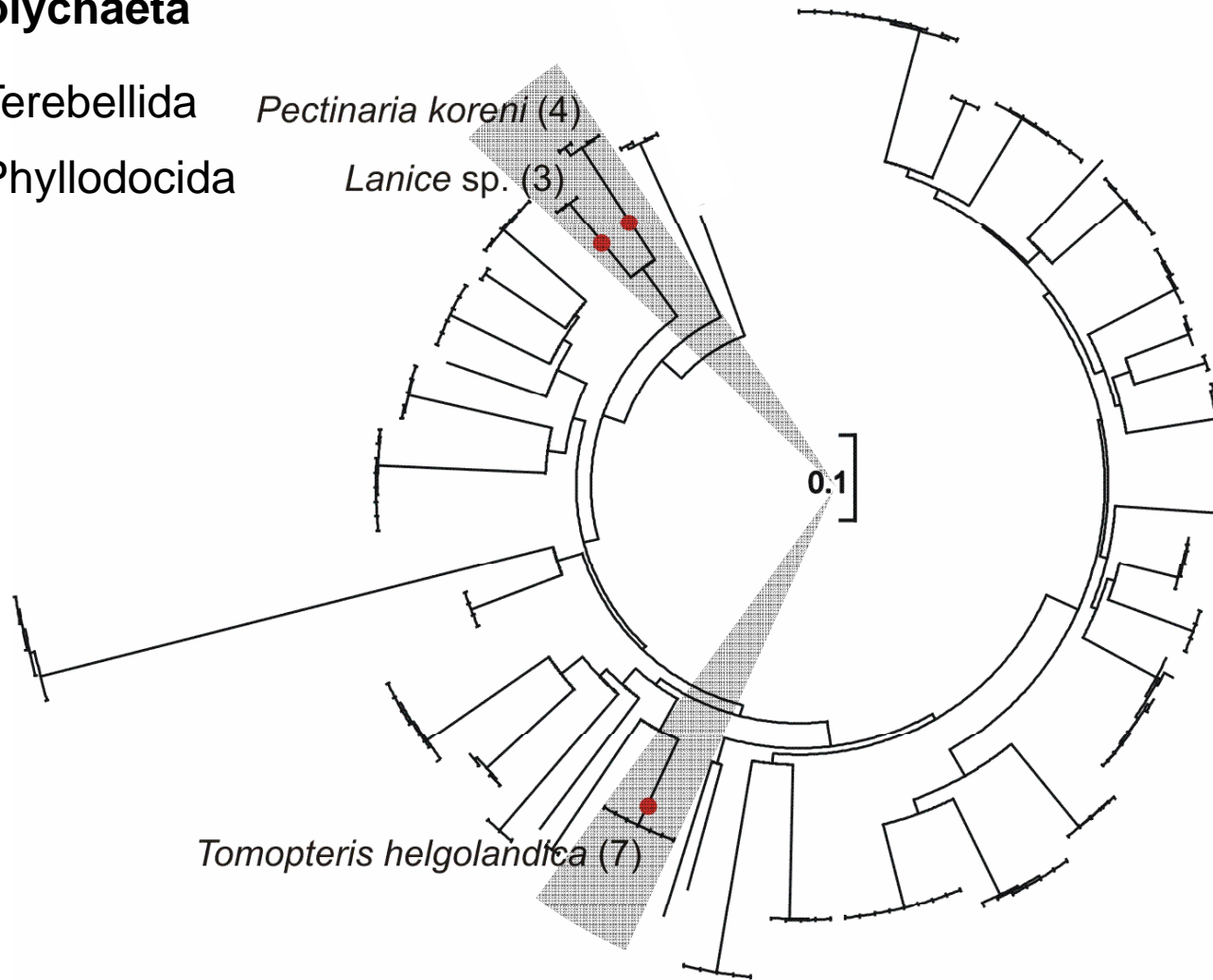
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Polychaeta

- Terebellida *Pectinaria koreni* (4)
- Phyllodocida *Lanice* sp. (3)



● Bootstrap value >95%

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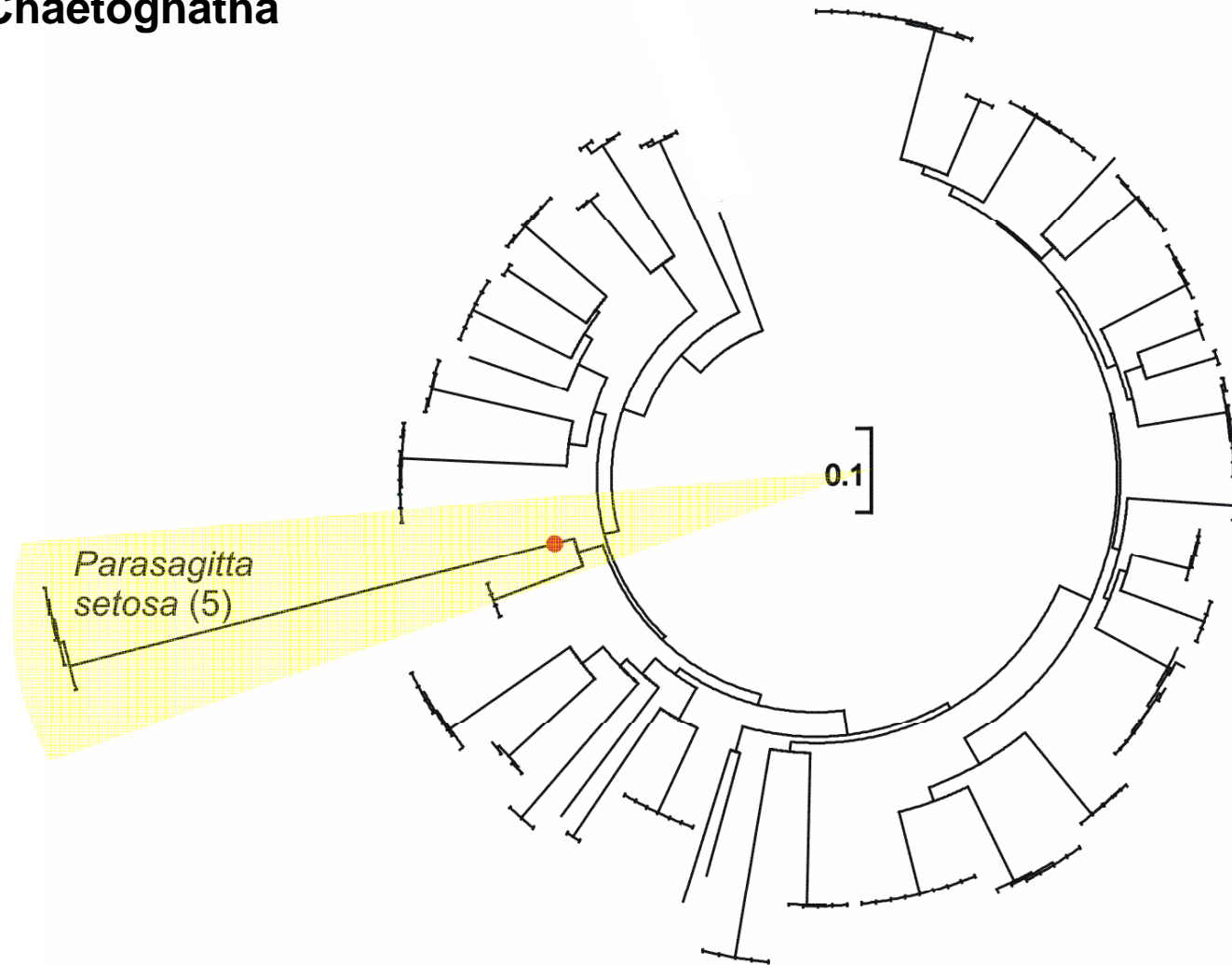
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Chaetognatha



● Bootstrap value >95%

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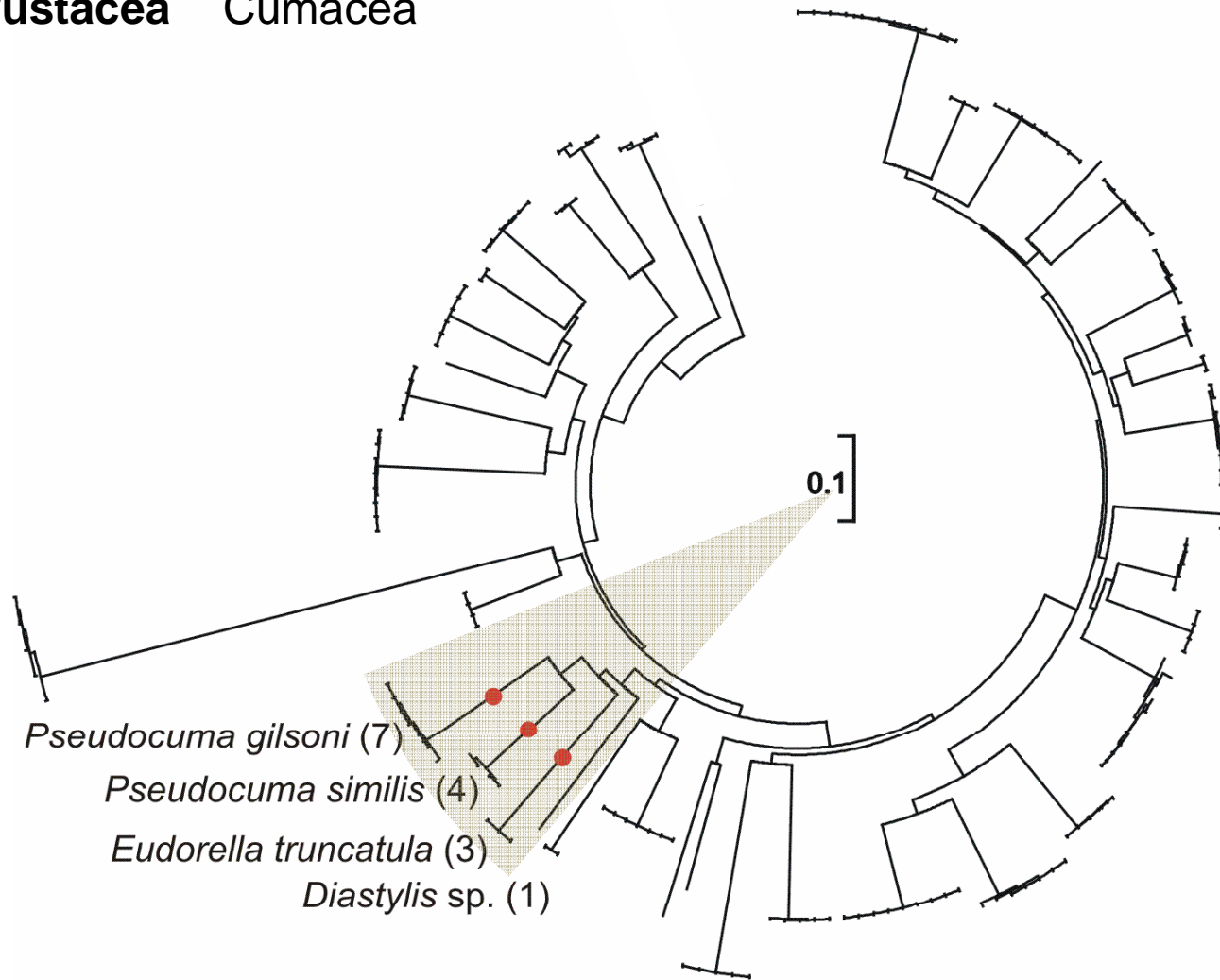
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Crustacea Cumacea



● Bootstrap value >95%

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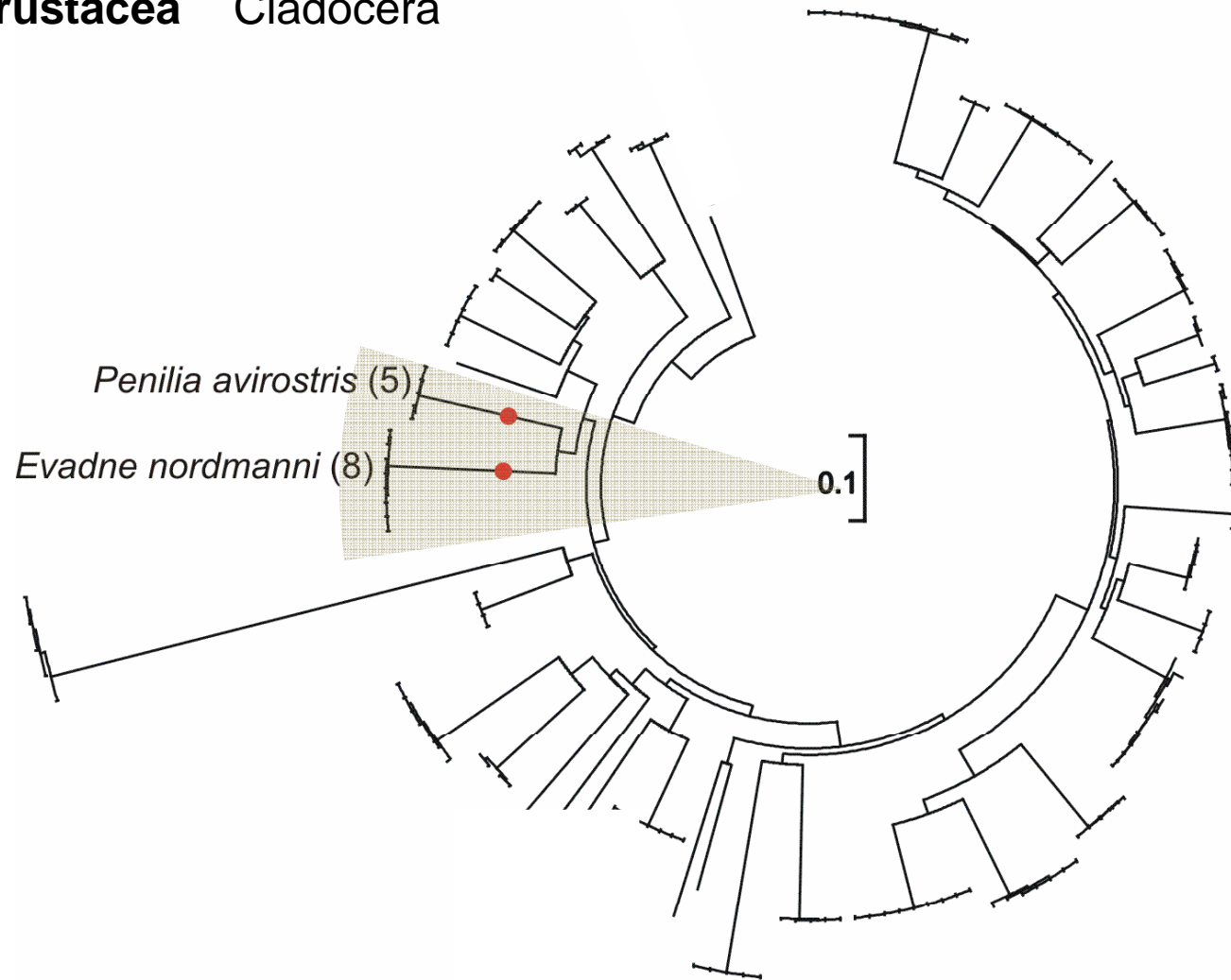
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Crustacea Cladocera



● Bootstrap value >95%

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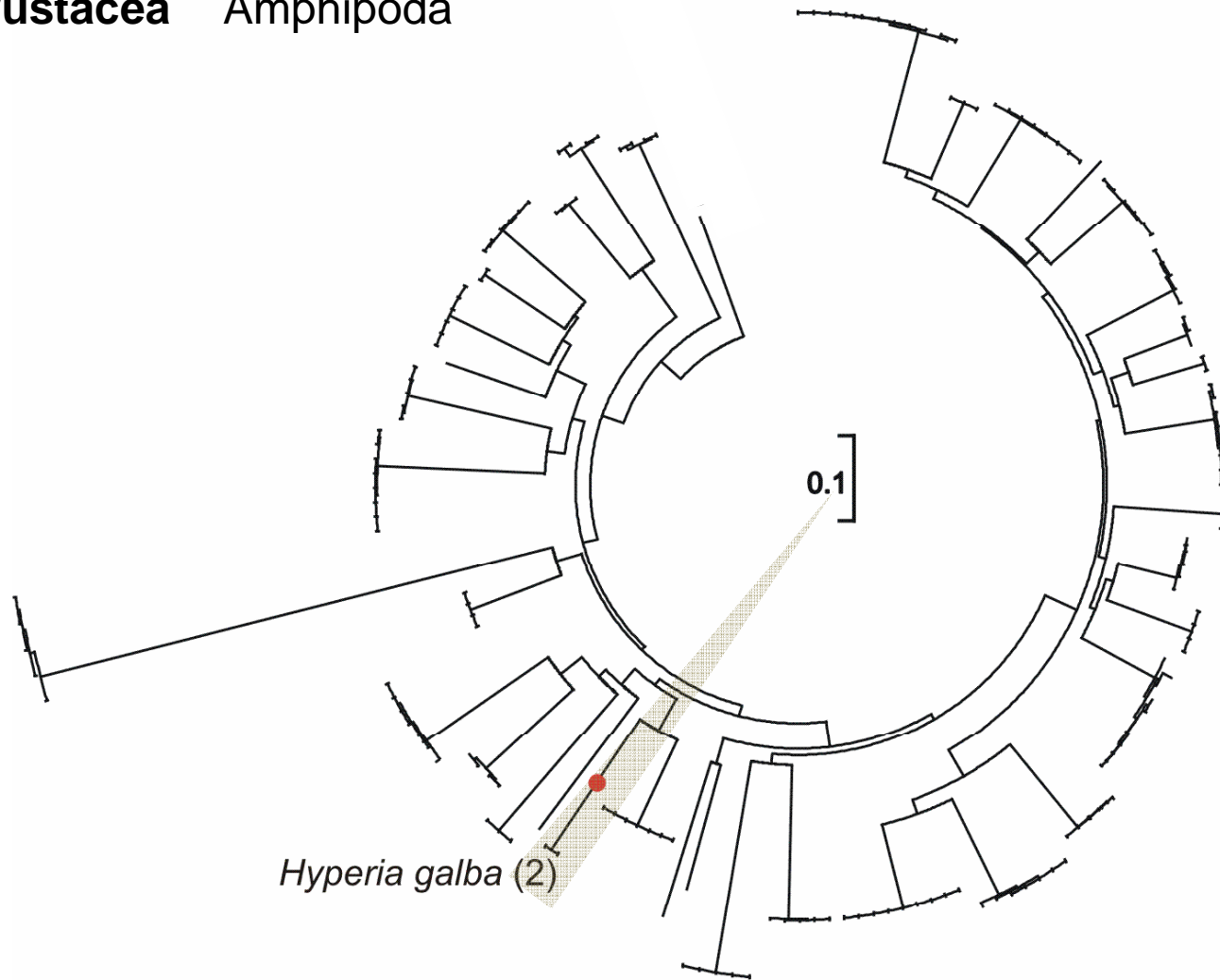
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Crustacea Amphipoda



● Bootstrap value >95%

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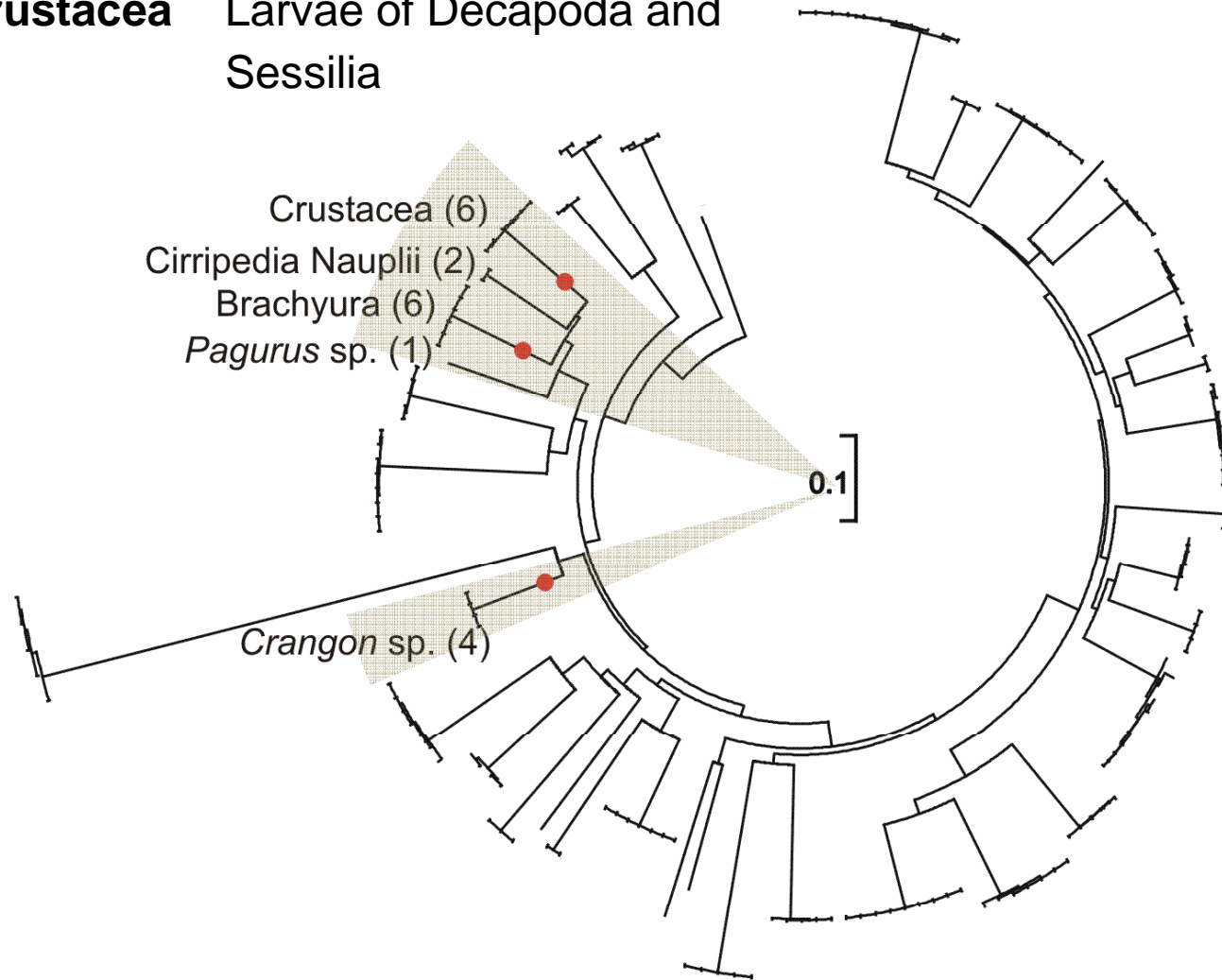
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Crustacea Larvae of Decapoda and Sessilia



● Bootstrap value >95%

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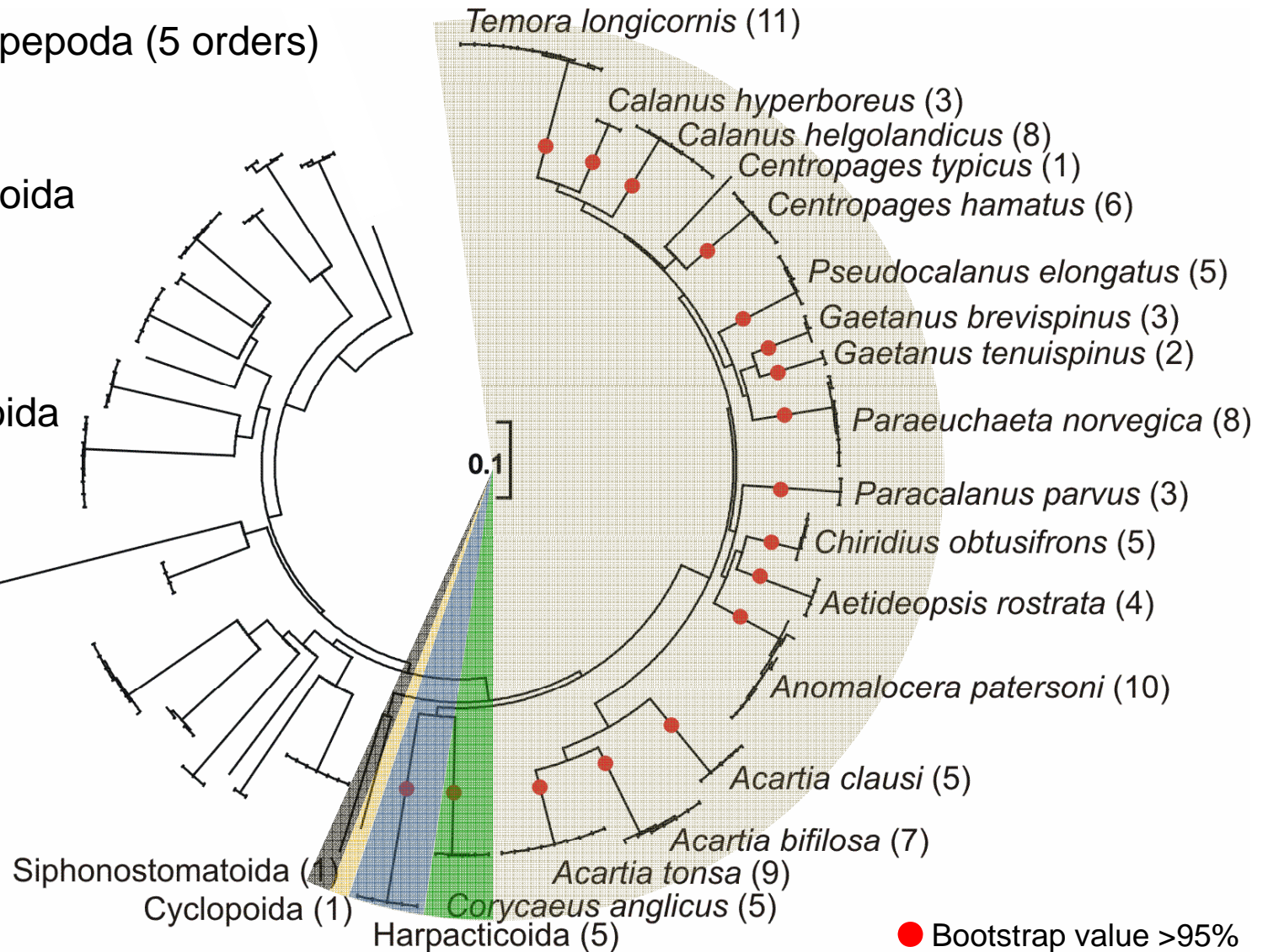
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Crustacea Copepoda (5 orders)

- Siphonostomatoida
- Cyclopoida
- Harpacticoida
- Poecilostomatoida
- Calanoida



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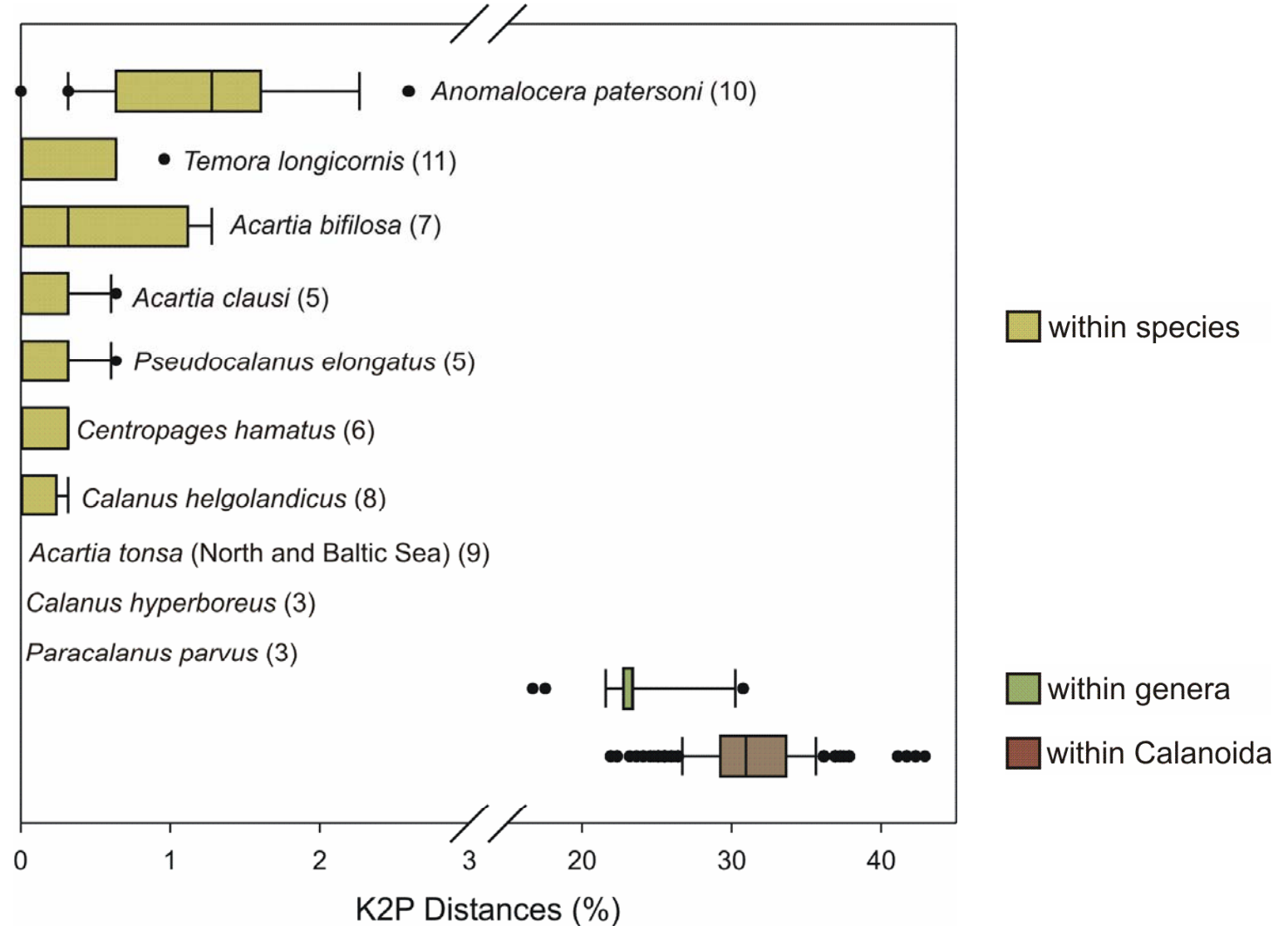
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Genetic distances of calanoid copepods



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The sequences ...

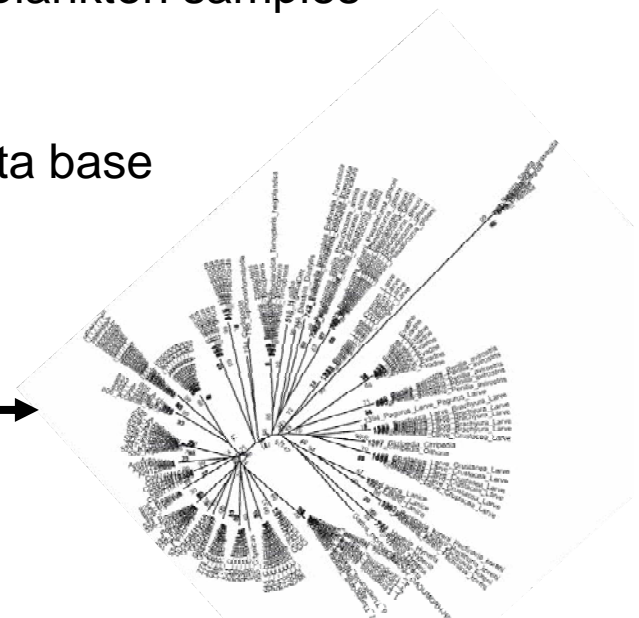
COI Additional characteristic for valid species identification

Detection of cryptic species

First indications of phylogeographic patterns of key species

18S Metagenetic analysis of environmental zooplankton samples
by pyrosequencing (454 Roche)

Sequences will be checked against own data base



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Poster: Inga Mohrbeck, Silke Laakmann, Thomas Knebelsberger and Michael J. Raupach: *First insights into the molecular diversity of the North Sea zooplankton*

Thanks

... for your attention

... for collecting and providing zooplankton samples

Dr. Maarten Boersma and Rebekka Schüller (Biological Institute Helgoland, Alfred-Wegener-Institute for Polar and Marine Research)

Dominik Gloe and students of the Institute for Hydrobiology and Fisheries Science, Hamburg University

Prof. Dr. Stefan Richter (Rostock University)

... for support in species identification

Dr. Terue C. Kihara and Annika Tiltack (DZMB, Senckenberg Institute)

Prof. Dr. Pedro Martínez Arbizu (DZMB, Senckenberg Institute)

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