

# Taxonomy meeting Societal needs: a taxonomist's view

*Geoff Boxshall*



# **Taxonomist's role – four main strands**

1. Diagnostics – determining identity and creating identification tools for others to use
2. Establishing and revising taxa, and building phylogenetic systems
3. Integrating biological information to build species “biographies”
4. Training the next generation of taxonomists

NB. No such entity as a “typical taxonomist” – nature of role individually variable

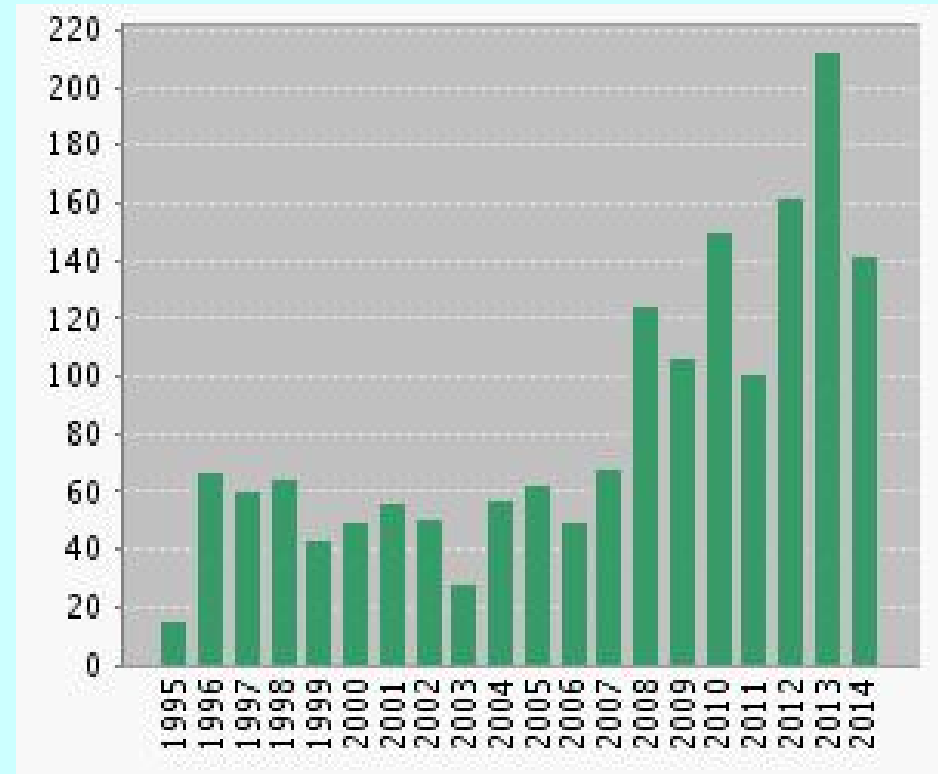
## **Issues of Relevance to Society - provide context (as drivers of Government spending)**

- Wealth generation
- Human health
- Predicting & managing impact of climate change
- Ecosystem functioning (sustainable provision of ecosystem services)
- Biodiversity conservation.....CBD compliance = legal framework

NB: Addressing these issues does not guarantee competitive funding

# A professional taxonomist also needs to build a career.

## World of Science citations



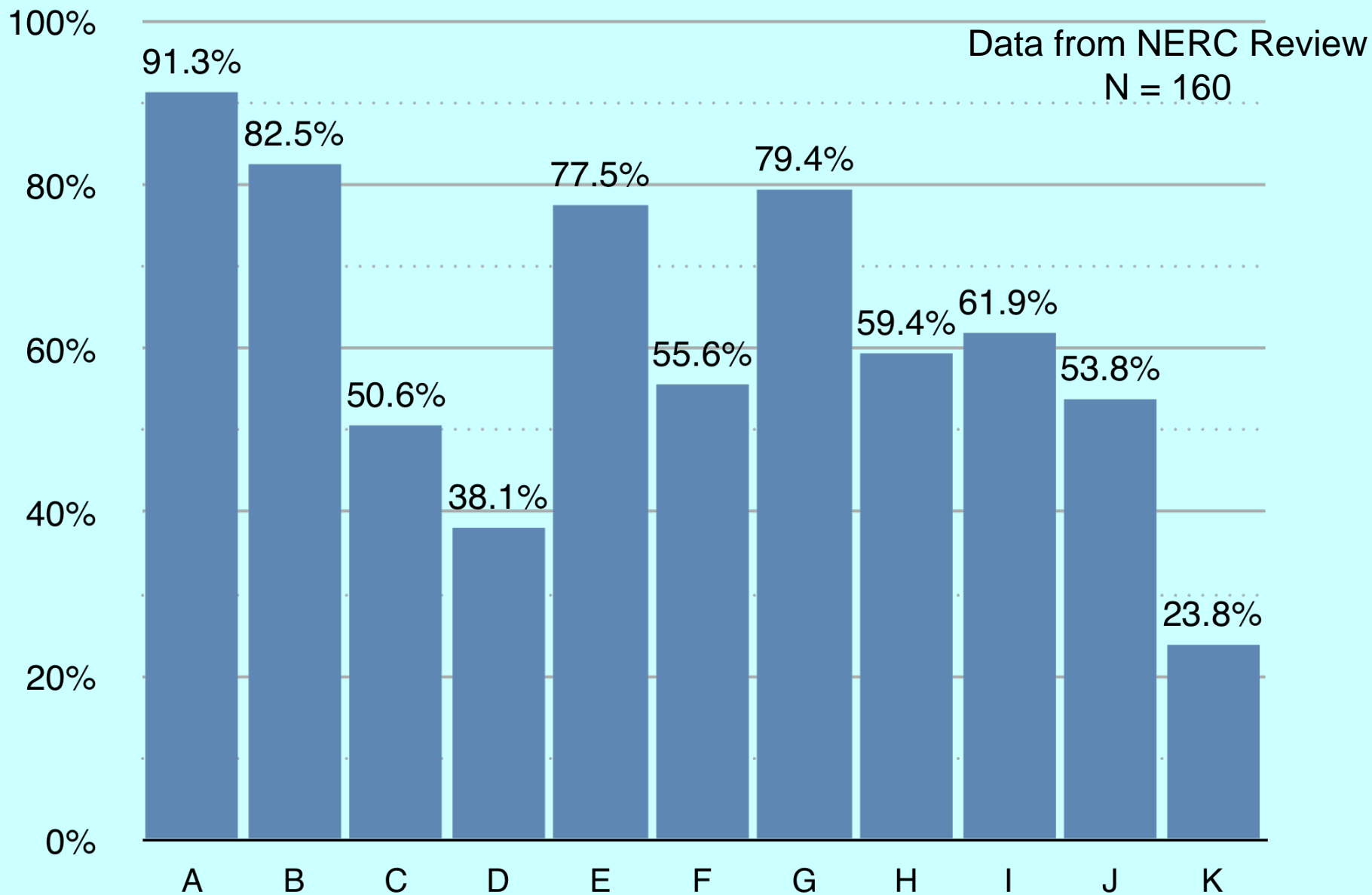
Results found: 183

Sum of the Times Cited: **1897**

Citing Articles: [1242](#)

Average Citations per Item: 10.37

h-index: **22**



*Outputs of modern taxonomists. A – Identifications, B – Descriptions, C - Phylogenetic Trees, D – Sequences, E - Voucher Specimens, F - Web pages, G – Databases, H – Checklists, I – Revisions, J - Identification Keys, K – Other.*



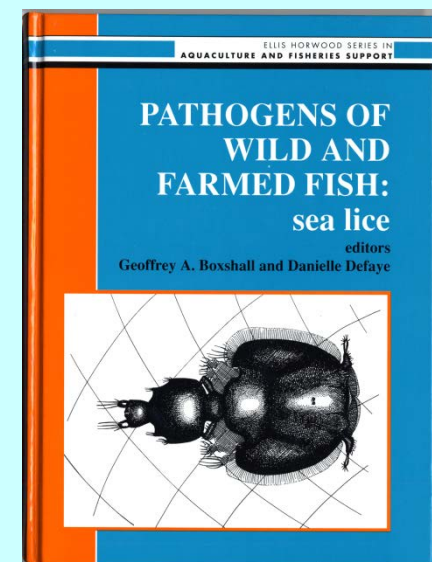
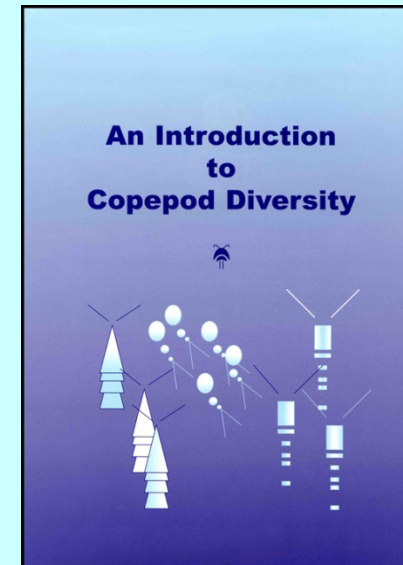
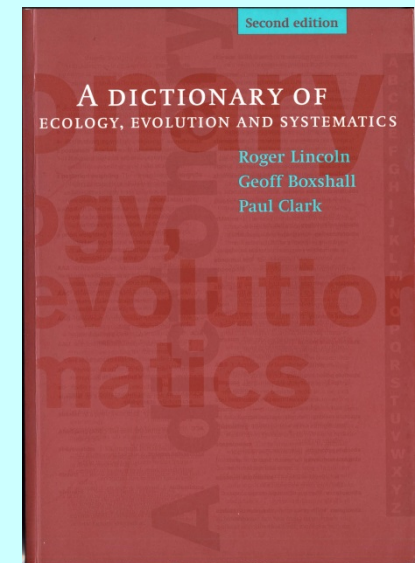
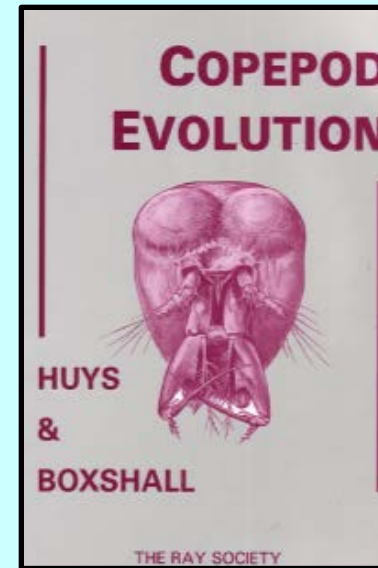
# Geoff Boxshall

Natural History Museum, London

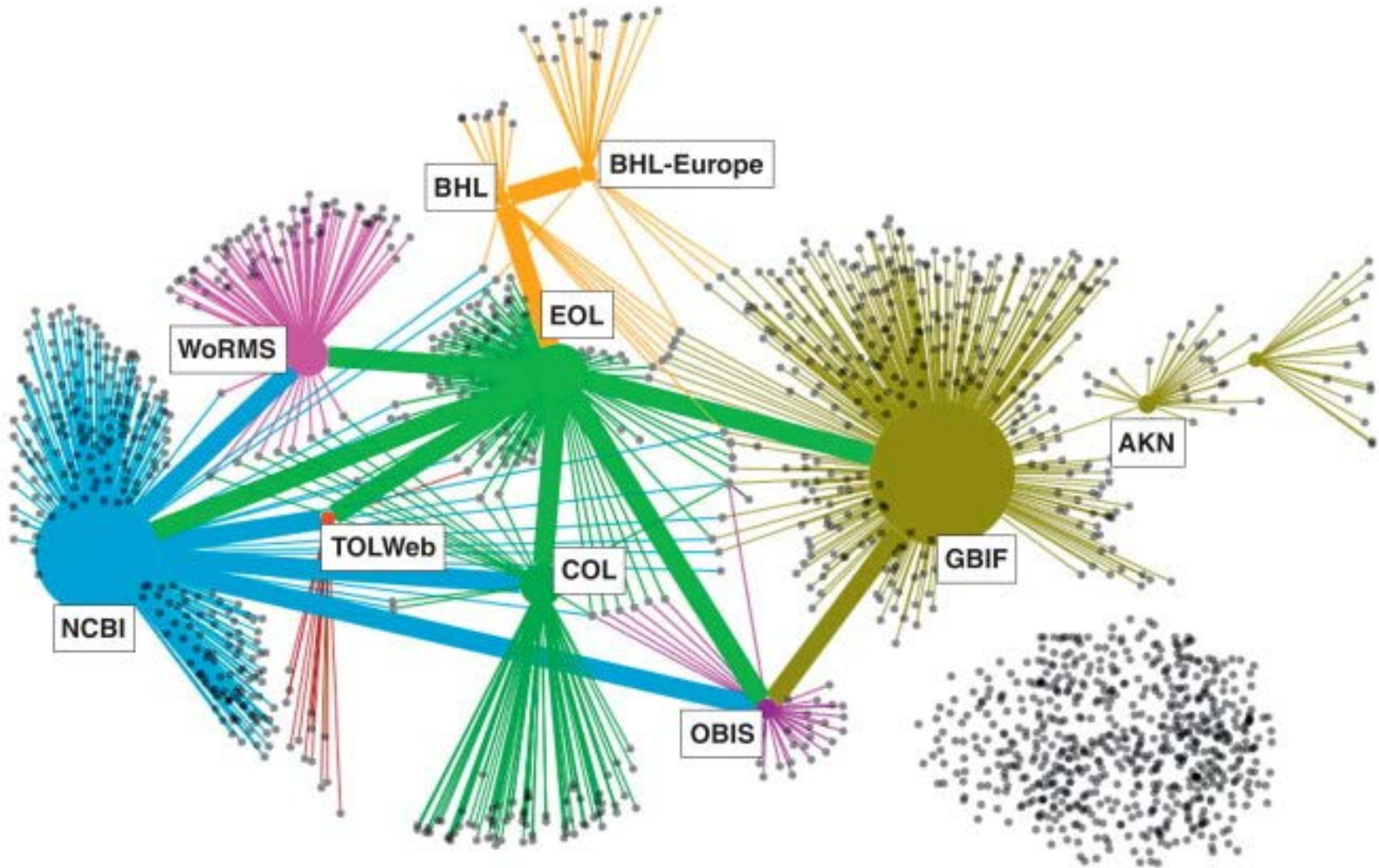
## Google Scholar

Citation indices	All	Since 2009
Citations	6039	2535
h-index	34	18
i10-index	124	45

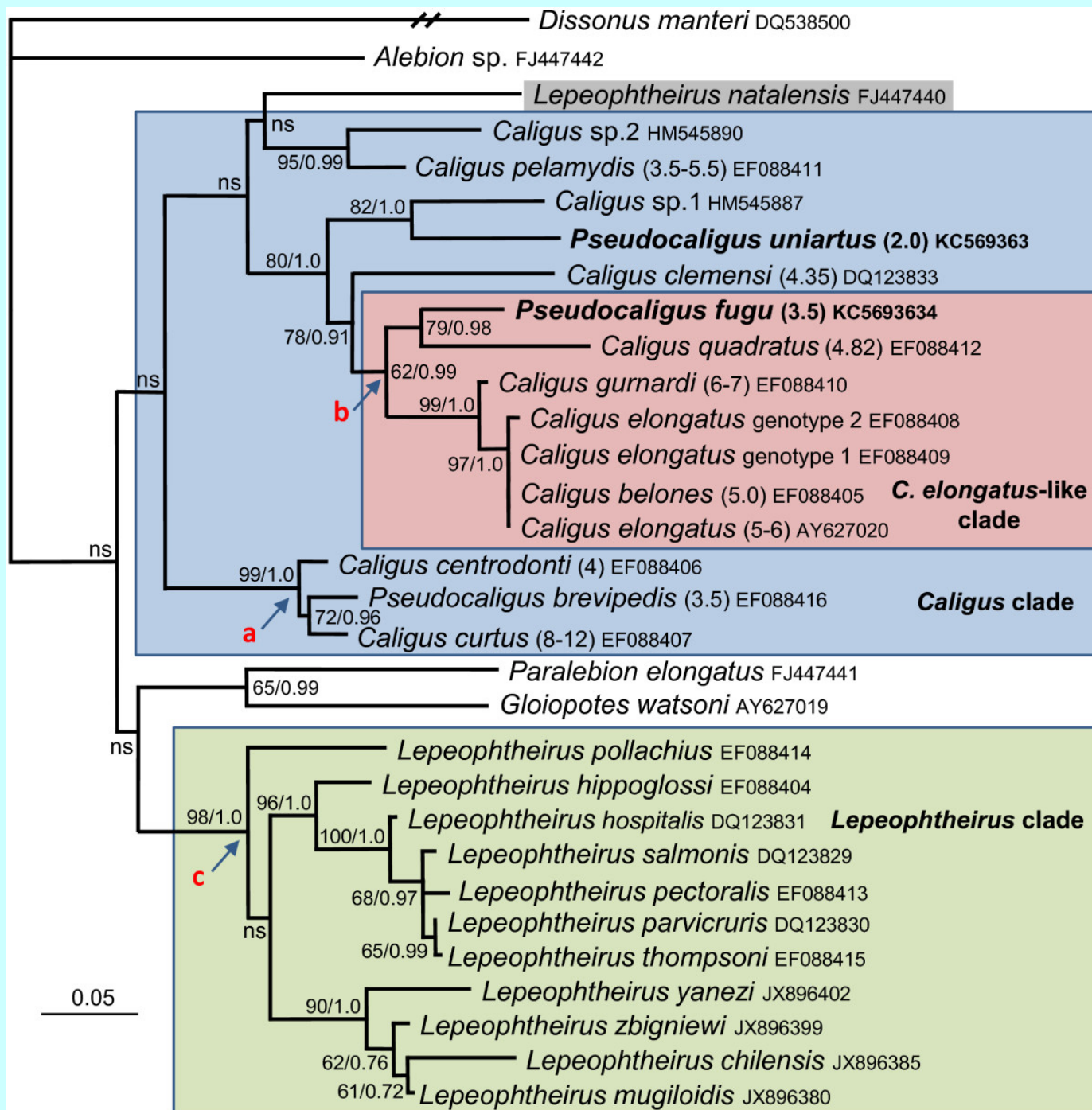
Title	Cited by	Year
<a href="#">Copepod evolution</a> R Huys, GA Boxshall Ray Society	1010	1991
<a href="#">A dictionary of ecology, evolution and systematics</a> RJ Lincoln, GA Boxshall, PF Clark Cambridge University Press	616	1998
<a href="#">An introduction to copepod diversity.</a> GA Boxshall, SH Halsey An introduction to copepod diversity	555	2004
<a href="#">World register of marine species</a> W Appeltans, P Bouchet, GA Boxshall, K Fauchald, DP Gordon, ...	257	2011
<a href="#">The evolution of arthropod limbs</a> GA Boxshall Biological Reviews 79 (02), 253-300	111	2004
<a href="#">Infections with parasitic copepods in North Sea marine fishes</a> GA Boxshall Journal of the Marine Biological Association of the United Kingdom 54 (02 ...	89	1974
<a href="#">The magnitude of global marine species diversity</a> W Appeltans, ST Ahyong, G Anderson, MV Angel, T Artois, N Bailly, ... Current Biology 22 (23), 2189-2202	85	2012
<a href="#">The ontogeny and phylogeny of copepod antennules</a> GA Boxshall, R Huys Philosophical Transactions of the Royal Society of London. Series B ...	74	1998
<a href="#">The comparative anatomy of two copepods, a predatory calanoid and a particle-feeding mormonilloid</a> GA Boxshall Philosophical Transactions of the Royal Society of London. Series B ...	70	1985
<a href="#">Pathogens of wild and farmed fish: sea lice</a> CRC Press	68	2006
<a href="#">Copepods parasitic on Brazilian coastal fishes: a handbook</a> GA Boxshall, MA Montú Nauplius 5 (1), 1-225	66	1997
<a href="#">Global diversity of copepods (Crustacea: Copepoda) in freshwater</a> GA Boxshall, D Defaye Hydrobiologia 595 (1), 195-207	65	2008
<a href="#">On the identity of the common Caligus (Copepoda: Siphonostomatoida: Caligidae) from salmonid netpen systems in southern Chile</a> GA Boxshall, S Bravo Contributions to Zoology 69 (1/2), 137-146	57	2000



# A huge array of on-line resources now available

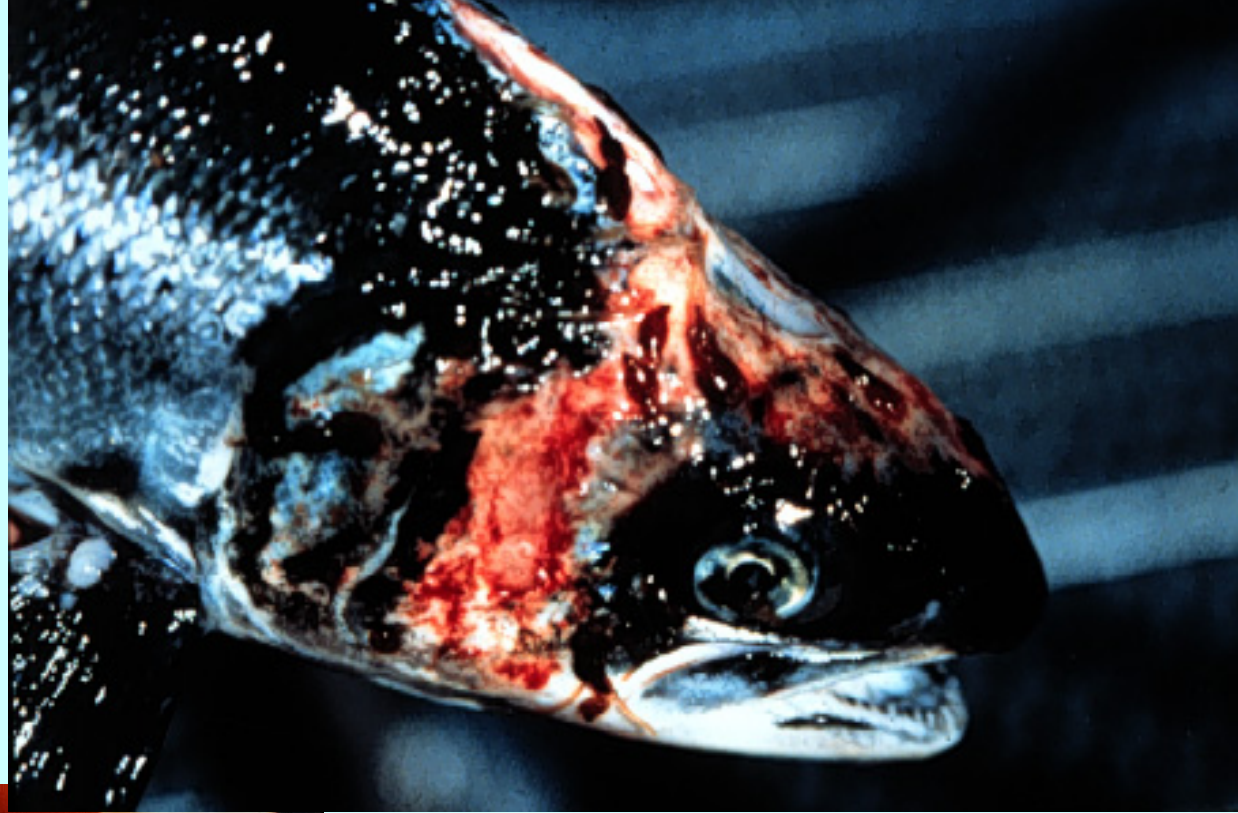


*TRENDS in Ecology & Evolution*



Freeman et al.,  
2013

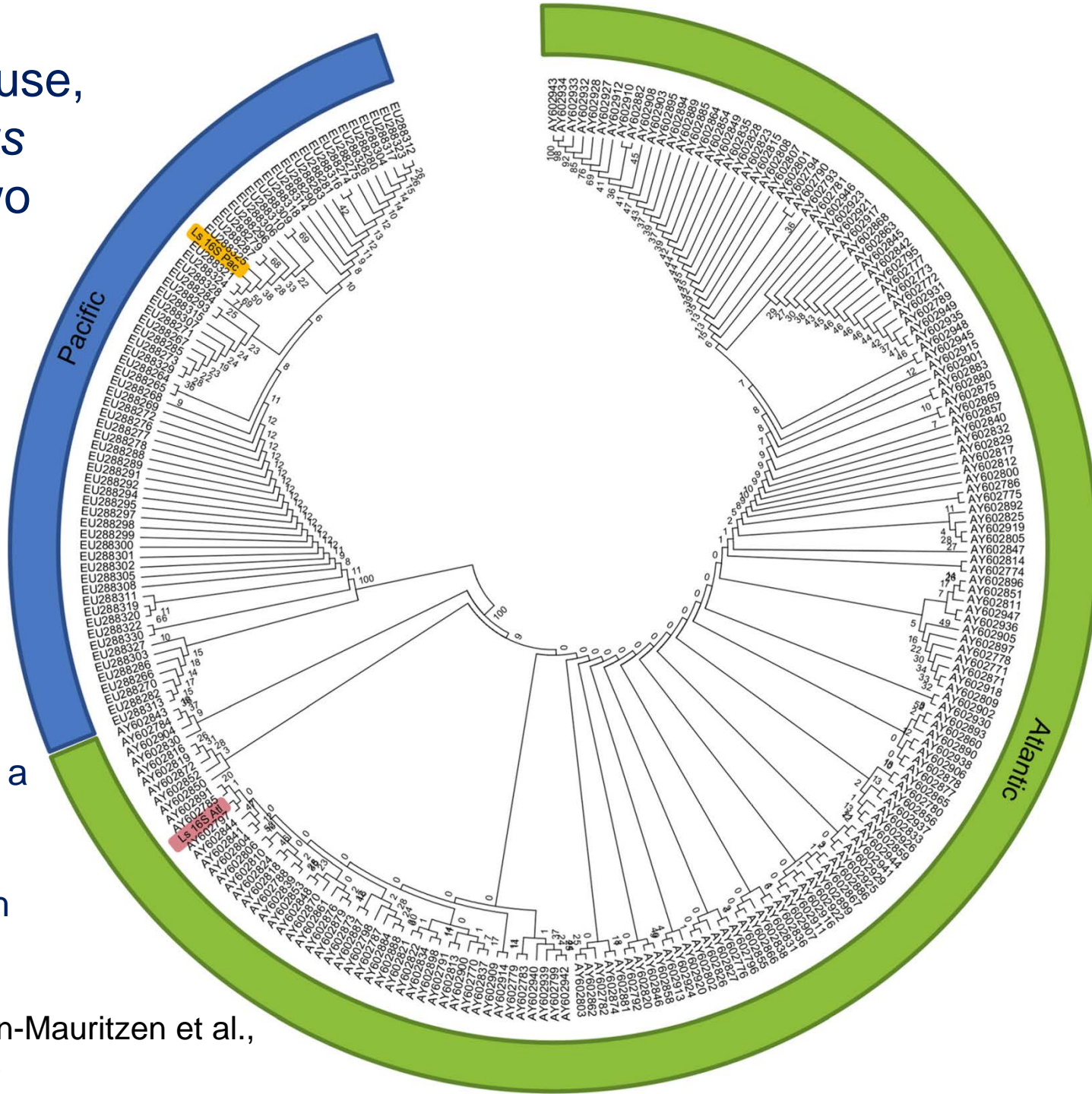
Caligid sealice  
cause over €100  
million p.a.  
losses to salmon  
farming industry



The salmon louse, *Lepeophtheirus salmonis*, is two species.

Cryptic species are a major problem but we now have the tools to look at such problems.

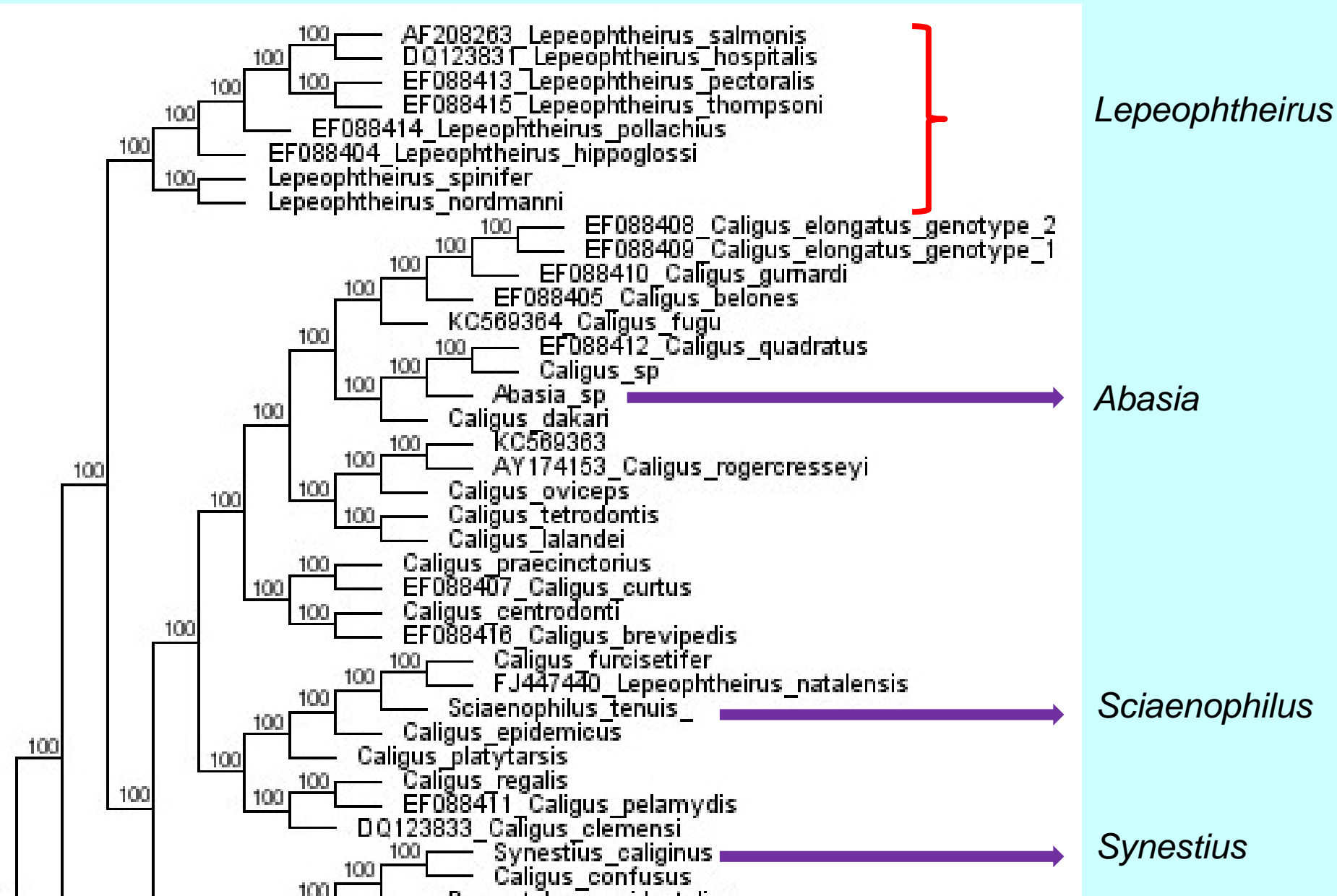
Skern-Mauritzen et al.,  
2014



# Caligidae

MP tree based on 18s and Co1

Work with Polly Hayes



*Synestius*



*Sciaenophilus*

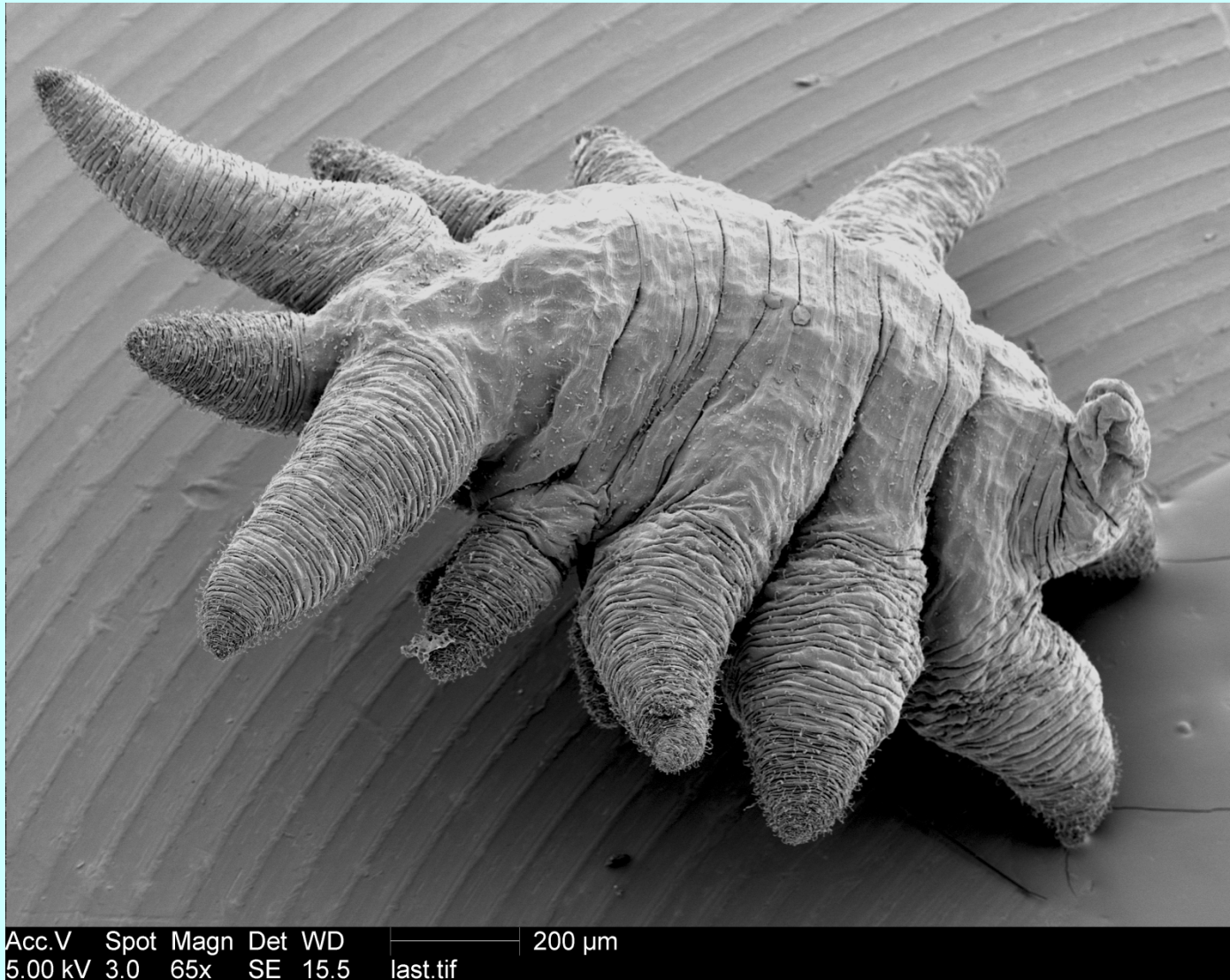


*Midias*



Several genera of Caligidae recognised as valid on basis of morphology (Dojiri & Ho, 2013) are not robust

# Species descriptions: why did I describe this?



*Achelidelphys papuensis* – parasite in colonial tunicate from Papua New Guinea

1. What's the question?

2. Is it high priority and can I get funding?

3. What approach/es should I use?

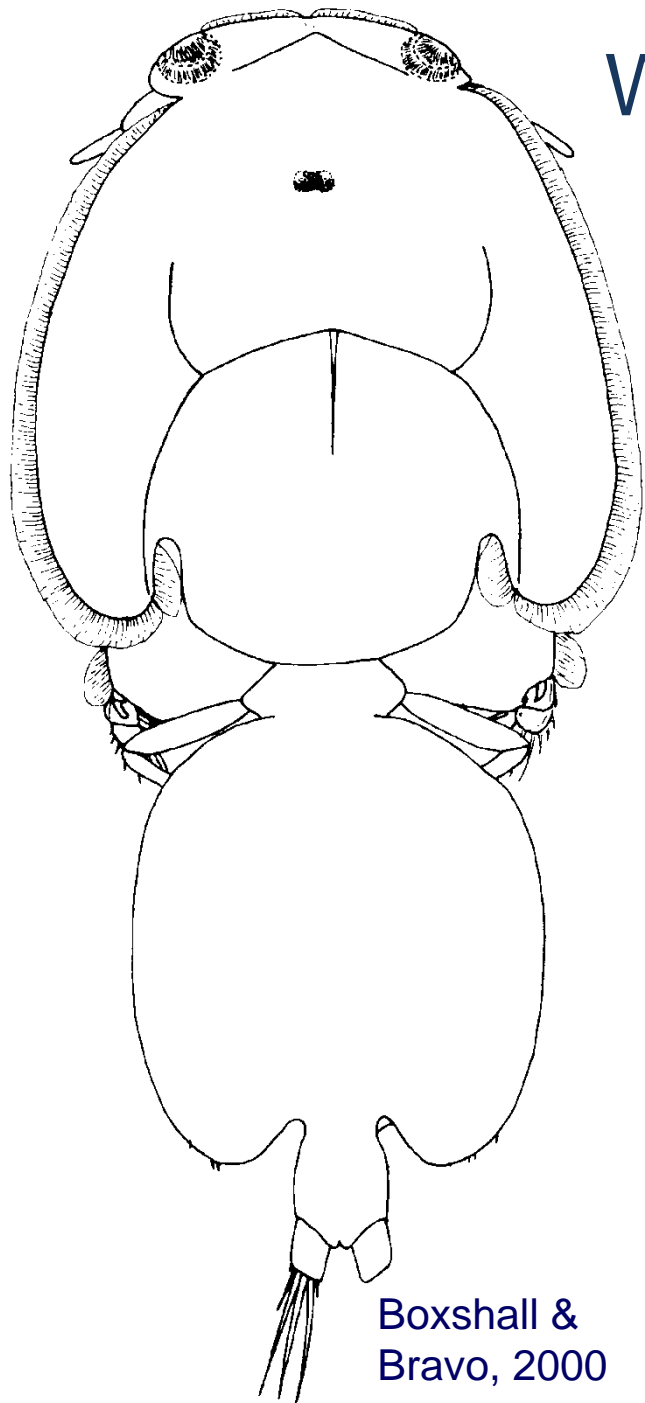
Morphology

Bar-coding, metagenomics, genomics, transcriptomics .....?-omics

4. What is the appropriate scale?

Local  National  Global

5. Does it fit Institutional Science Strategy?

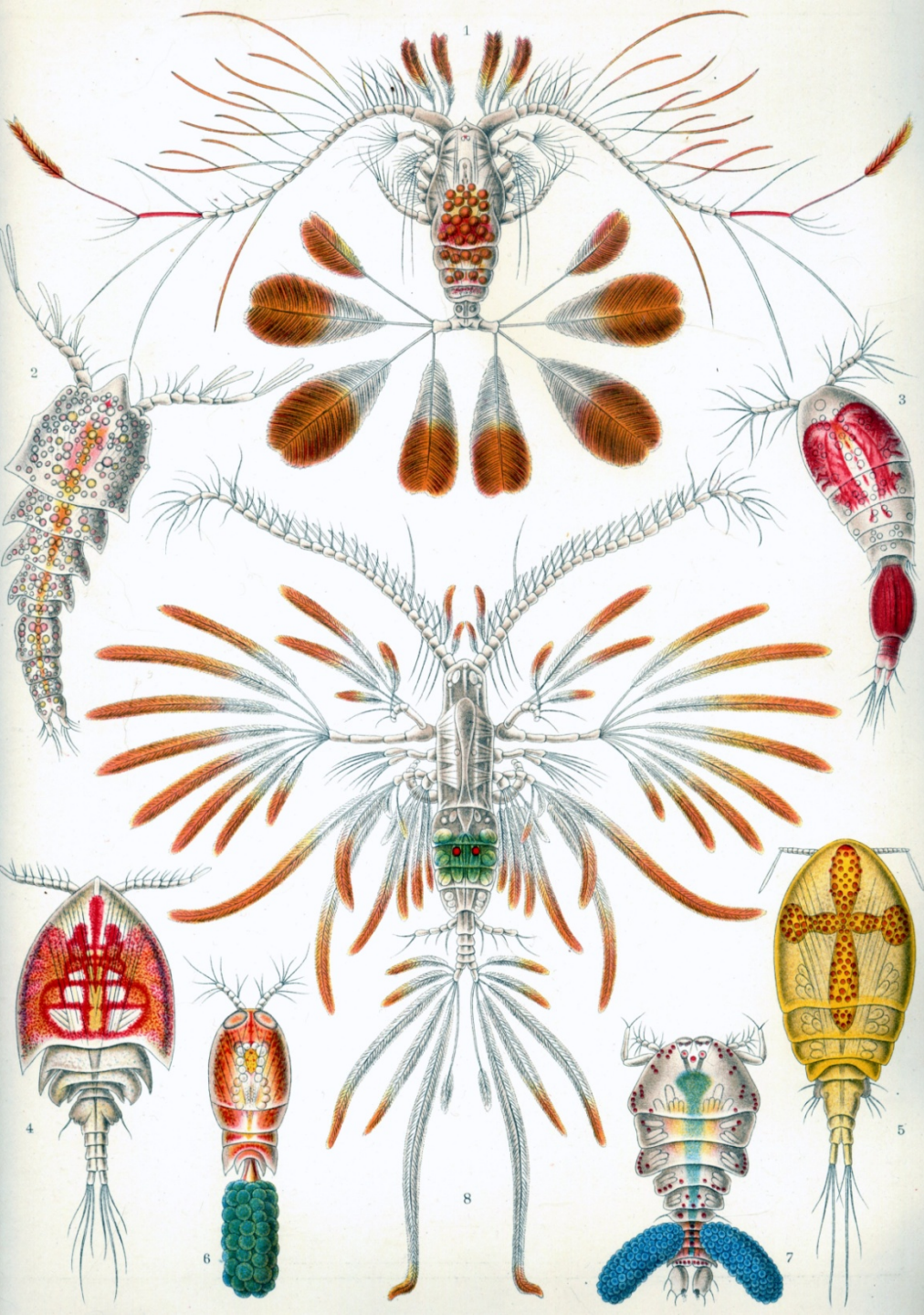


Boxshall &  
Bravo, 2000

## Why did I describe this *Caligus*?

In Chile *Caligus rogercresseyi* switched from native hosts (Nototheniidae, Atheriniidae & Paralichthyidae) to farmed salmonids & is huge problem.

The genome of the salmon louse has been assembled: both Atlantic and Pacific forms of *L. salmonis*, and *C. rogercresseyi* has also been sequenced but not fully assembled yet.



Another argument for me to articulate is the under-appreciation of the diversity and importance of parasites in marine ecosystems. Confronting this general lack of awareness is another valid reason to focus on parasites.

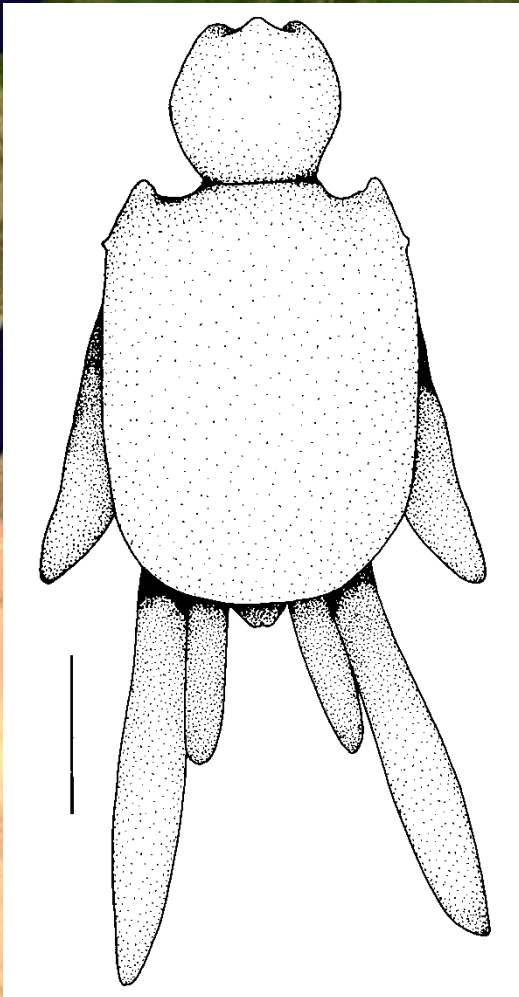
Invasive species are also a hook that can be used to construct fundable projects: invasives often leave their parasites behind (the enemy-release hypothesis) - but not in the Eastern Mediterranean.

# Invasive species in E. Mediterranean



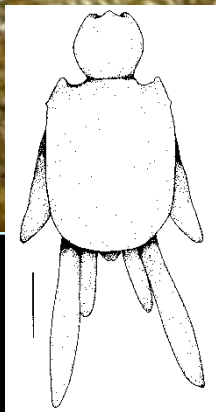
Photo: NASA

# Invasive species in E. Mediterranean

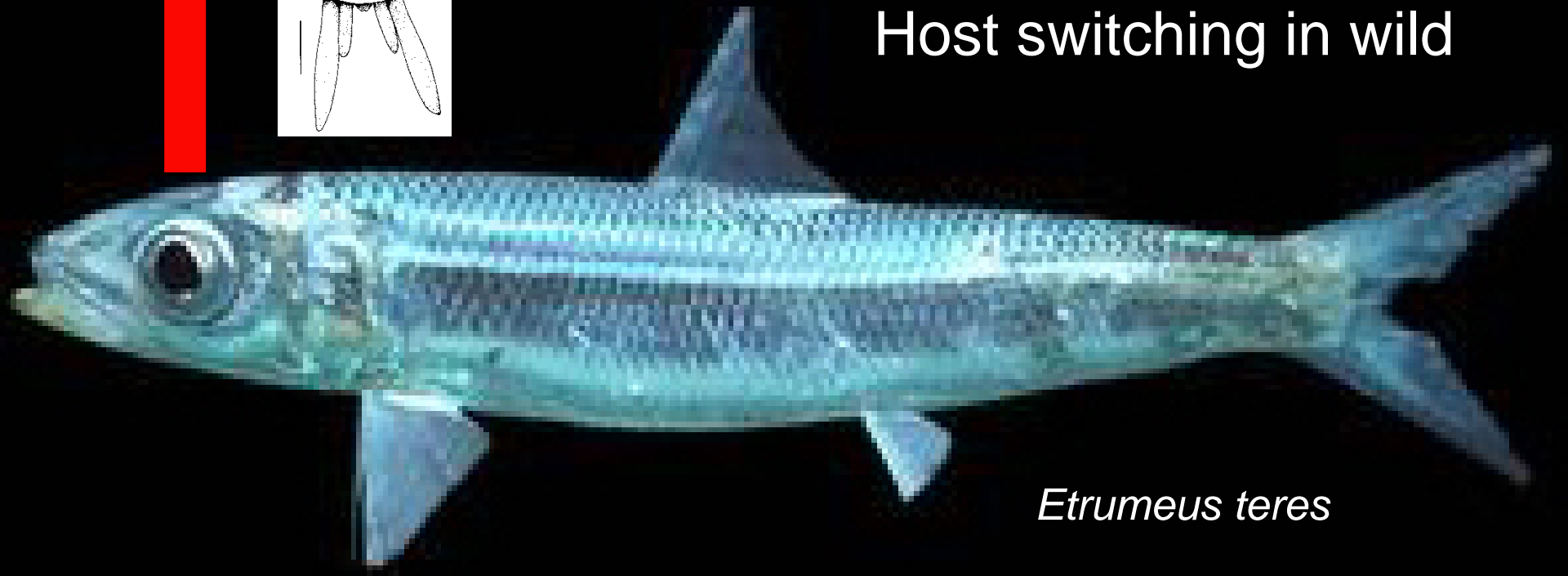




*Sardinella aurita*

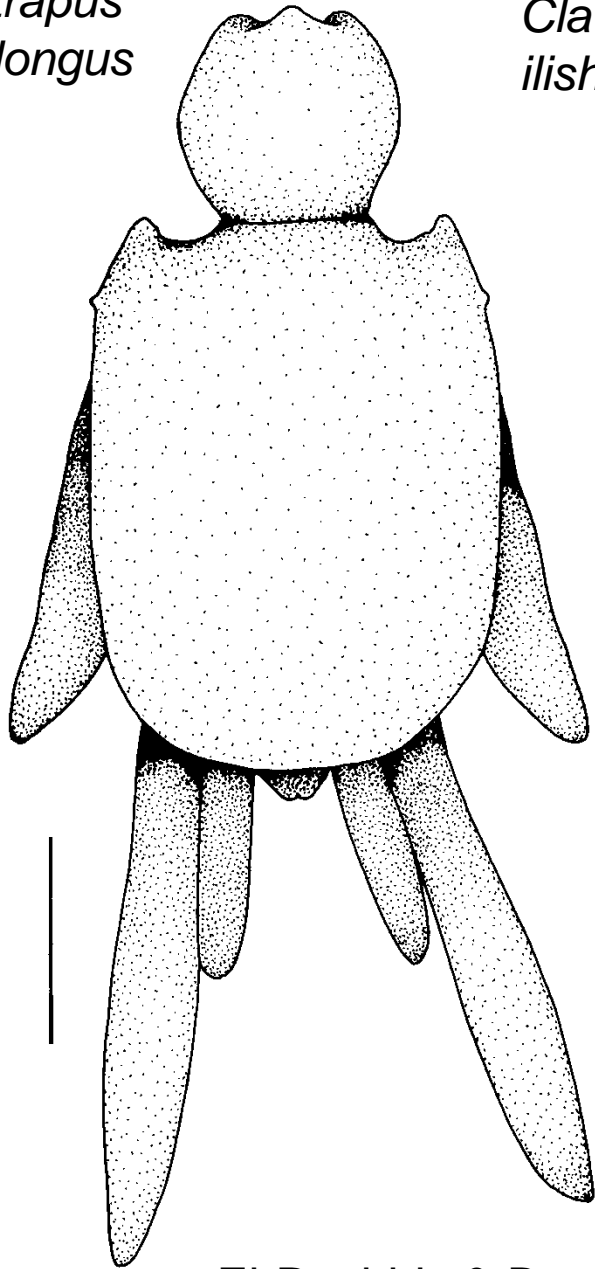


Host switching in wild

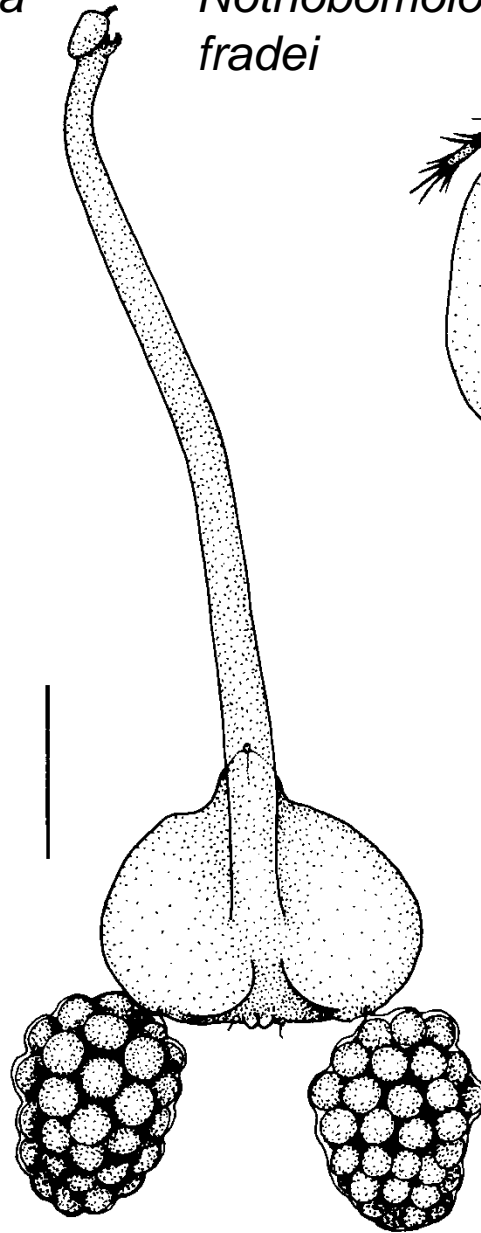


*Etrumeus teres*

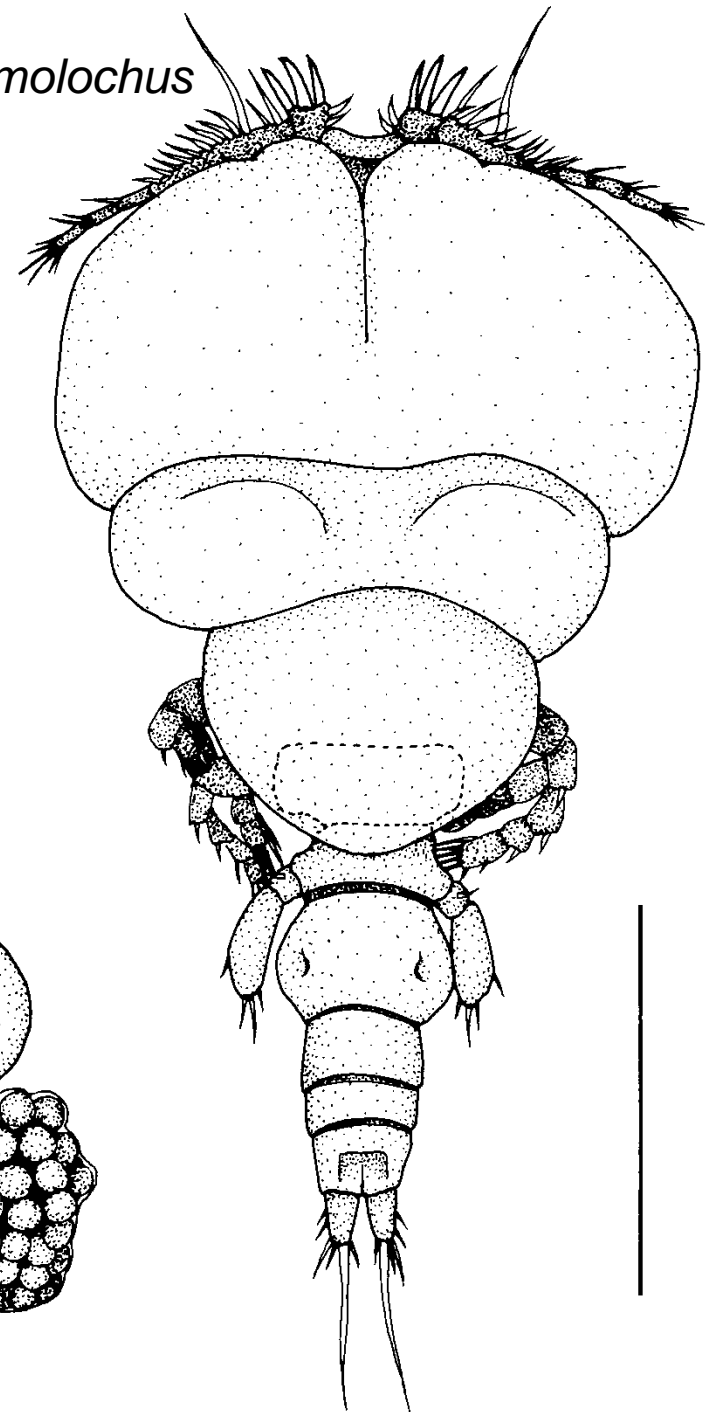
*Mitrapus oblongus*



*Clavellisa ilishae*



*Nothobomolochus fradei*



El-Rashidy & Boxshall, 2009, 2010

During my 40 years I have established:

16 new families, 1 new order & 1 new subclass of Crustacea

and I have described:

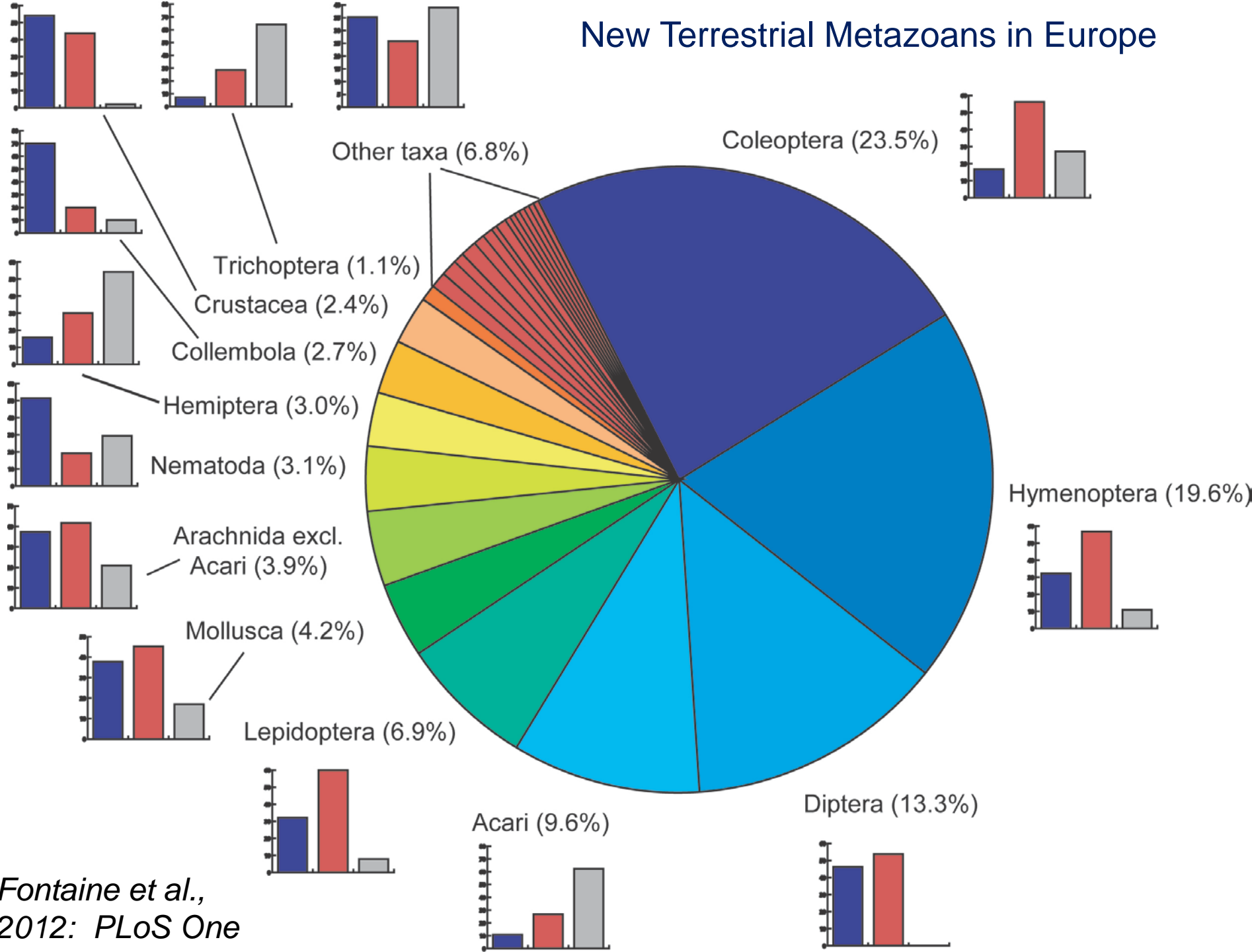
over 200 new species mostly of copepods - but including a few isopods, tantulocarids, branchiurans and other random crustaceans (fossil and Recent).

I wouldn't make the same choices now, because priorities change and taxonomists must adapt like all other scientists. On balance I'd probably describe fewer species....

So who is describing new species now?

5,881 new species of terrestrial metazoans were described and added to *Fauna Europaea* during the decade 1998-2007.

# New Terrestrial Metazoans in Europe



# 5,881 new species (1998-2007)

1. 1323 unique authors – we were able to assess employment status of 1000.
2. 42.8% - “paid” taxonomists
3. 57.2% - volunteer taxonomists (10.5% retired professionals, 46.7% volunteers)
4. Paid taxonomists described 37.8% n.spp.
5. Volunteers described 62.2% of new spp. including 52.7% of new Diptera and 26.7% of new mites

# Changing Perceptions:

In 19<sup>th</sup> Century taxonomy was at the cutting edge of biological science.

There were periods in the late 20<sup>th</sup> Century when it was viewed as a quaint “folk industry”.

With the resurgence of natural history and the focus on biodiversity, we are now somewhere between these extremes, but professional taxonomists need to work hard to articulate the relevance of what we do to the needs of society.

