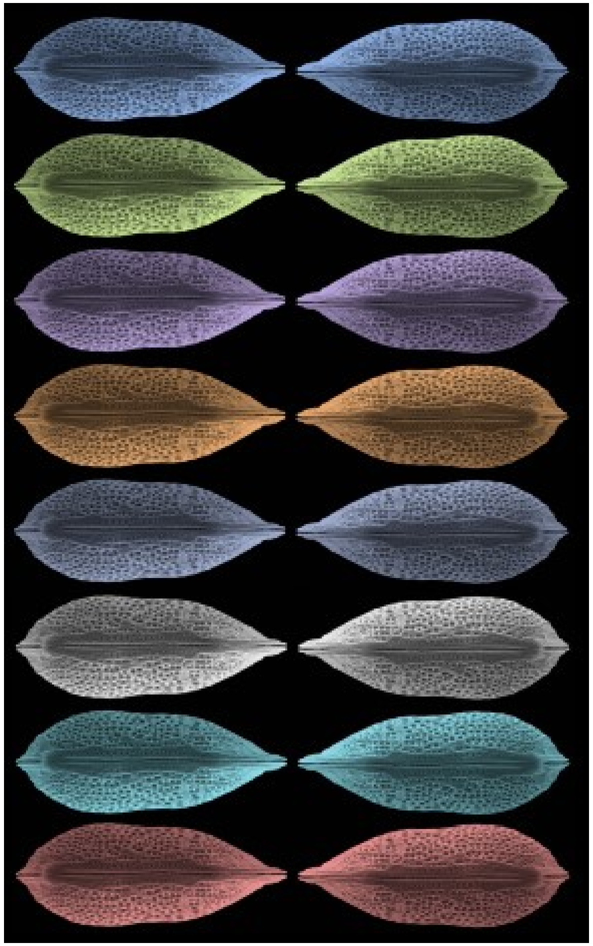
Animali fantastici e dove trovarli: gli ostracodi delle sorgenti montane



Giampaolo Rossetti
Dipartimento di Scienze chimiche, della vita e della sostenibilità ambientale
Università di Parma

Non ho la valigia di Newt Scamander…

© Warner Bros.

Newton "Newt" Artemis Fido Scamander, Ordine di Merlino (Seconda Classe) (nato il 24 Febbraio 1897) era un famoso Magizoologo e autore di "Animali fantastici e dove trovarli". Nei primi anni della sua vita Scamander ha sviluppato un interesse per le creature magiche, influenzato dalla madre che allevava Ippogrifi.

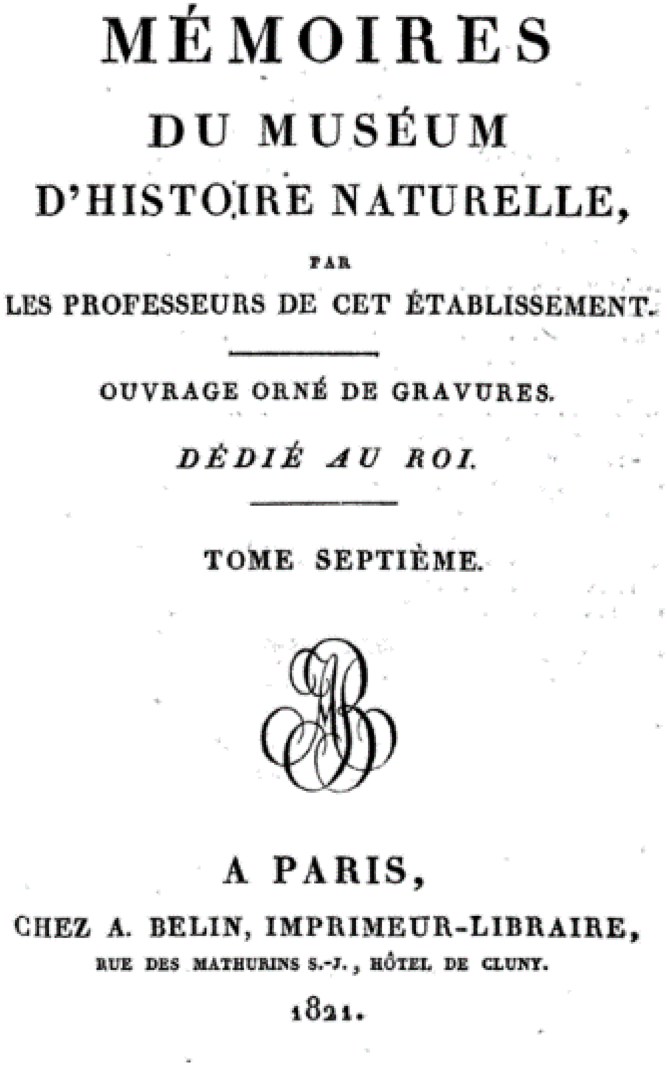
https://harrypotter.fandom.com/it/wiki/Newton_Scamander

Ostracodi?!?

…This is another of those luckless groups of animals that hardly anyone is interested in, despite being extremely common and critical to many ecosystems.

www.newscientist.com/article/dn22595-zoologger-the-toughest-eggs-in-the-world.html

Da *Monoculus concha pedata* in poi…



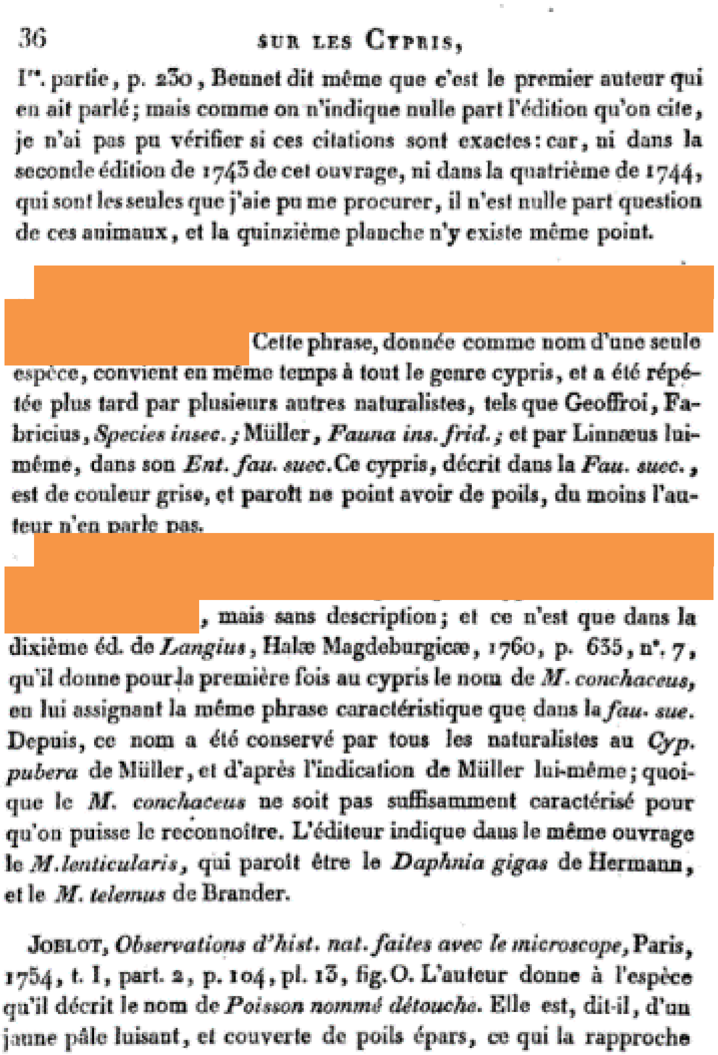
MÉMOIRES
DU MUSÉUM
D'HISTOIRE NATURELLE,
PAR
LES PROFESSEURS DE CET ÉTABLISSEMENT.

OUVRAGE ORNÉ DE GRAVURES.

DÉDIÉ AU ROI.

TOME SEPTIÈME.

A PARIS,
CHEZ A. BELIN, IMPRIMEUR-LIBRAIRE,
RUE DES MATHURINS S.-J., HÔTEL DE CLUNY.
1821.



36 SUR LES CYPRIS,

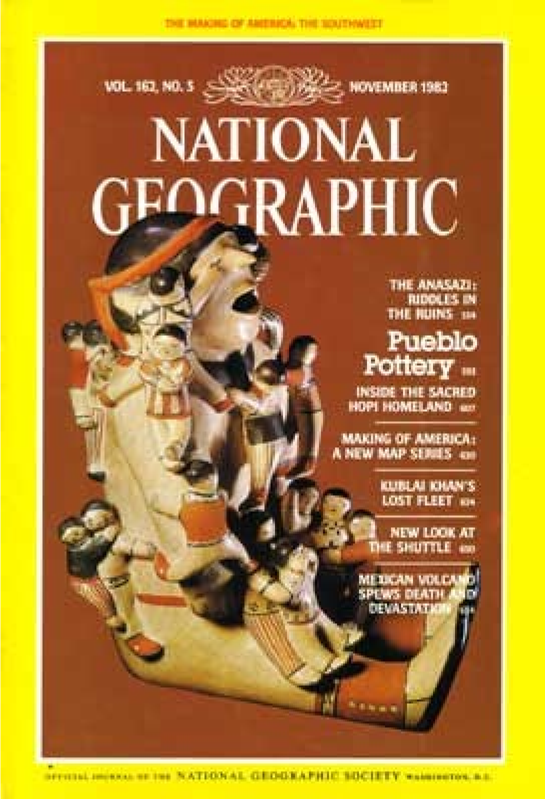
Ire. partie, p. 230, Bennet dit même que c'est le premier auteur qui en ait parlé; mais comme on n'indique nulle part l'édition qu'on cite, je n'ai pas pu vérifier si ces citations sont exactes: car, ni dans la seconde édition de 1743 de cet ouvrage, ni dans la quatrième de 1744, qui sont les seules que j'aie pu me procurer, il n'est nulle part question de ces animaux, et la quinzième planche n'y existe même point.

[redacted] Cette phrase, donnée comme nom d'une seule espèce, convient en même temps à tout le genre cypris, et a été répétée plus tard par plusieurs autres naturalistes, tels que Geoffroi, Fabricius, *Species insec.*; Müller, *Fauna ins. frid.*; et par Linnæus lui-même, dans son *Ent. fau. suec.* Ce cypris, décrit dans la *Fau. suec.*, est de couleur grise, et paroît ne point avoir de poils, du moins l'auteur n'en parle pas.

[redacted], mais sans description; et ce n'est que dans la dixième éd. de *Langius*, Halæ Magdeburgicæ, 1760, p. 635, n°. 7, qu'il donne pour la première fois au cypris le nom de *M. conchaceus*, en lui assignant la même phrase caractéristique que dans la *fau. sue.* Depuis, ce nom a été conservé par tous les naturalistes au *Cyp. pubera* de Müller, et d'après l'indication de Müller lui-même; quoique le *M. conchaceus* ne soit pas suffisamment caractérisé pour qu'on puisse le reconnoître. L'éditeur indique dans le même ouvrage le *M. lenticularis*, qui paroît être le *Daphnia gigas* de Hermann, et le *M. telemus* de Brander.

JOBLOT, *Observations d'hist. nat. faites avec le microscope*, Paris, 1754, t. I, part. 2, p. 104, pl. 13, fig. O. L'auteur donne à l'espèce qu'il décrit le nom de *Poisson nommé détouche*. Elle est, dit-il, d'un jaune pâle luisant, et couverte de poils épars, ce qui la rapproche

La prima illustrazione di un ostracode?



THE MAKING OF AMERICA: THE SOUTHWEST

VOL. 162, NO. 5 NOVEMBER 1982

NATIONAL GEOGRAPHIC

THE ANASAZI: RIDDLES IN THE RUINS

Pueblo Pottery

INSIDE THE SACRED HOPI HOMELAND

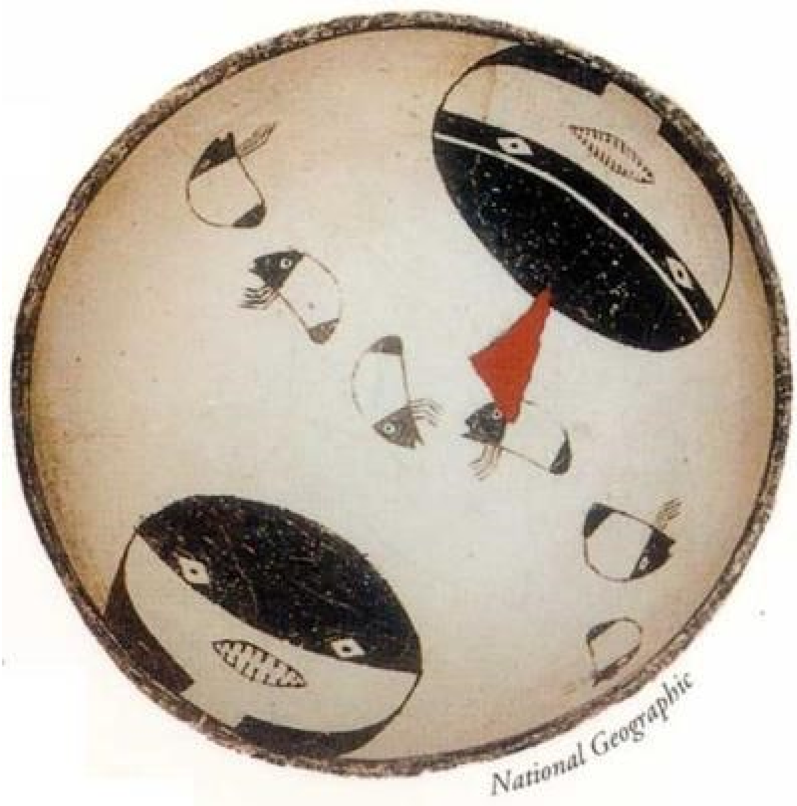
MAKING OF AMERICA: A NEW MAP SERIES

KUBLAI KHAN'S LOST FLEET

NEW LOOK AT THE SHUTTLE

MEXICAN VOLCANO SPEWS DEATH AND DEVASTATION

OFFICIAL JOURNAL OF THE NATIONAL GEOGRAPHIC SOCIETY WASHINGTON, D.C.

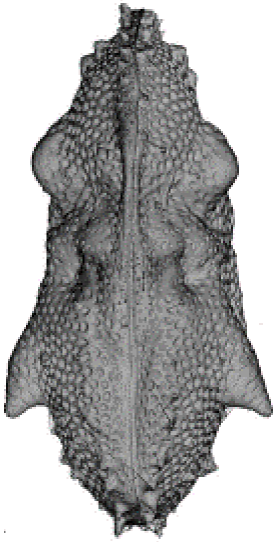


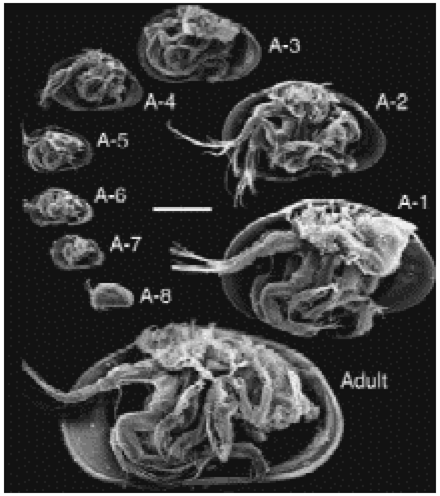
Ceramica Pueblo della cultura Mogollon, prodotta nell’area della Mimbres Valley (New Mexico) tra il 1000 e il 1150 d.C. Sono rappresentati ostracodi appartenenti al genere *Chlamydotheca* o *Magalocypris*. National Geographic 162(5):593-605.

https://www.bgs.ac.uk/discoveringGeology/time/fossilfocus/ostracod.html#folkloreAndFact

Classe Ostracoda

- circa 33000 specie descritte (fossili e recenti)
- dimensioni adulti: 0.1-32 mm
- simmetria bilaterale del corpo
- carapace bivalve calcareo
- presenza di sette paia di appendici
- il ciclo vitale comprende 9 stadi di sviluppo post-embrionale
- dimorfismo sessuale
- riproduzione sessuale e/o asessuale

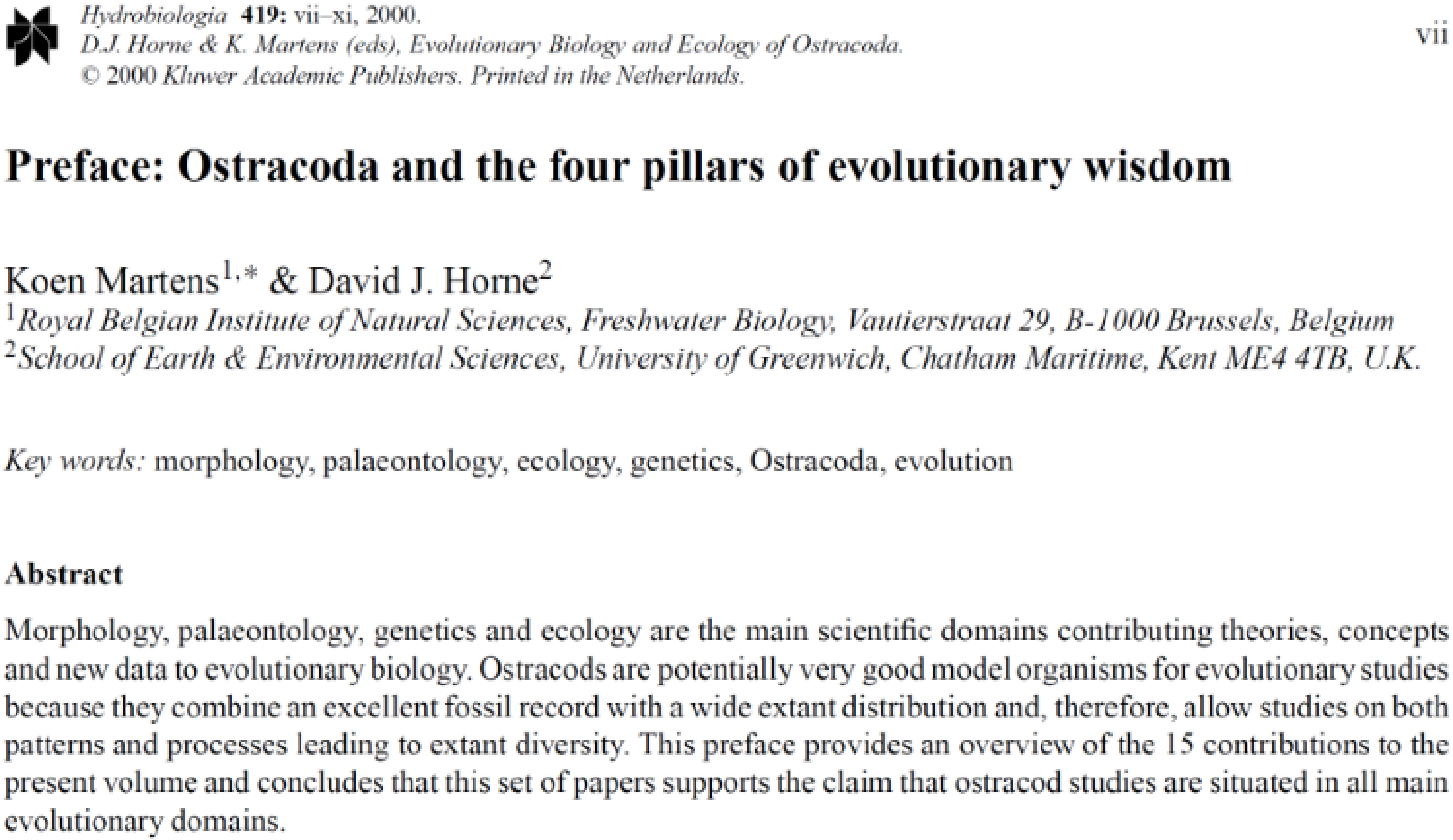




Smith & Martens, 2000

UNA MONTAGNA DI VITA
Ecosistemi d'alta quota e cambiamenti climatici

Gli ostracodi come organismi modello



Hydrobiologia **419:** vii–xi, 2000.
D.J. Horne & K. Martens (eds), Evolutionary Biology and Ecology of Ostracoda.
© 2000 *Kluwer Academic Publishers. Printed in the Netherlands.*

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Preface: Ostracoda and the four pillars of evolutionary wisdom

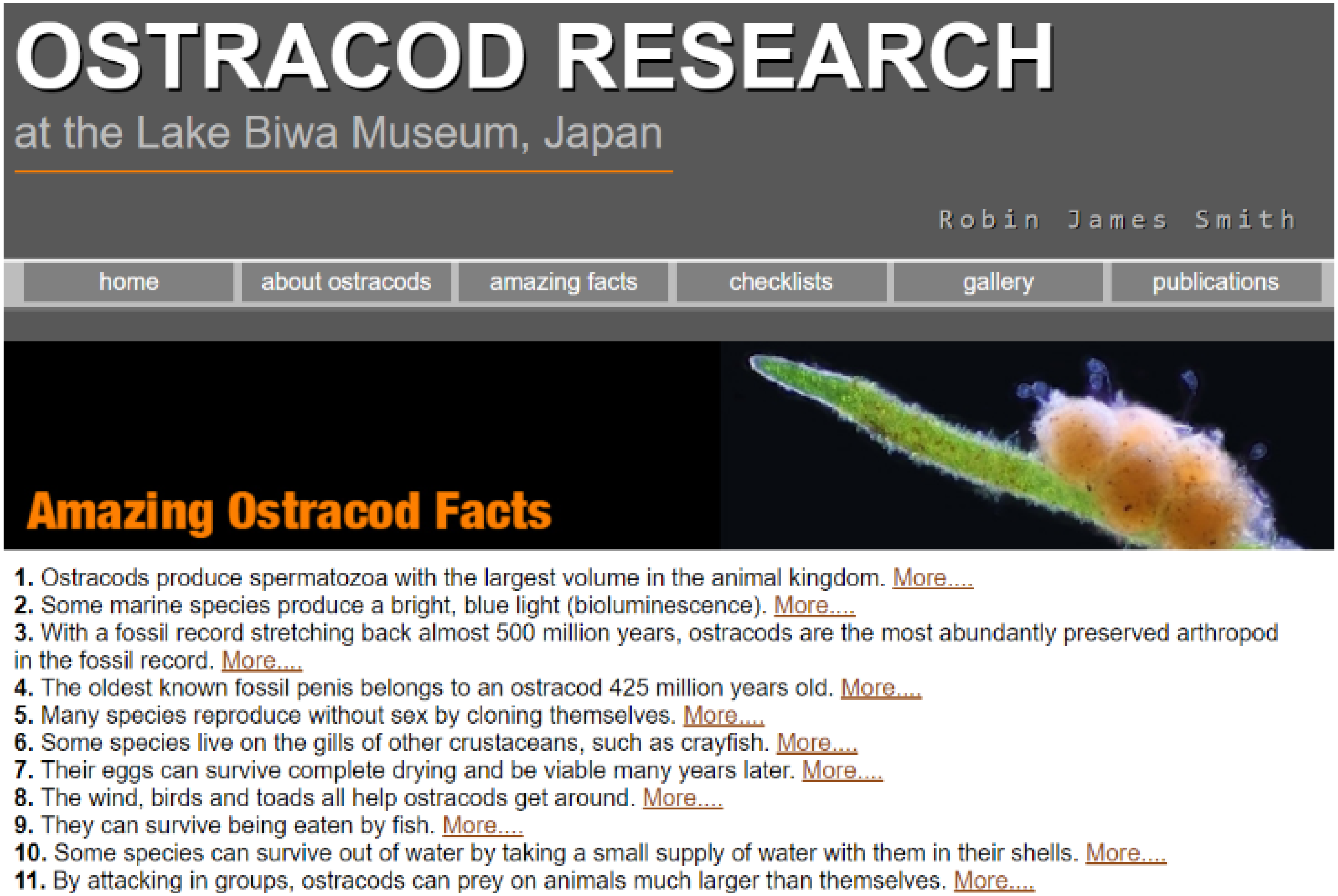
Koen Martens[1,*] & David J. Horne[2]
[1]*Royal Belgian Institute of Natural Sciences, Freshwater Biology, Vautierstraat 29, B-1000 Brussels, Belgium*
[2]*School of Earth & Environmental Sciences, University of Greenwich, Chatham Maritime, Kent ME4 4TB, U.K.*

Key words: morphology, palaeontology, ecology, genetics, Ostracoda, evolution

Abstract

Morphology, palaeontology, genetics and ecology are the main scientific domains contributing theories, concepts and new data to evolutionary biology. Ostracods are potentially very good model organisms for evolutionary studies because they combine an excellent fossil record with a wide extant distribution and, therefore, allow studies on both patterns and processes leading to extant diversity. This preface provides an overview of the 15 contributions to the present volume and concludes that this set of papers supports the claim that ostracod studies are situated in all main evolutionary domains.

Animali sicuramente fantastici!



OSTRACOD RESEARCH

at the Lake Biwa Museum, Japan

Robin James Smith

Amazing Ostracod Facts

1. Ostracods produce spermatozoa with the largest volume in the animal kingdom. More....
2. Some marine species produce a bright, blue light (bioluminescence). More....
3. With a fossil record stretching back almost 500 million years, ostracods are the most abundantly preserved arthropod in the fossil record. More....
4. The oldest known fossil penis belongs to an ostracod 425 million years old. More....
5. Many species reproduce without sex by cloning themselves. More....
6. Some species live on the gills of other crustaceans, such as crayfish. More....
7. Their eggs can survive complete drying and be viable many years later. More....
8. The wind, birds and toads all help ostracods get around. More....
9. They can survive being eaten by fish. More....
10. Some species can survive out of water by taking a small supply of water with them in their shells. More....
11. By attacking in groups, ostracods can prey on animals much larger than themselves. More....

https://www.biwahaku.jp/smith/facts.html#4

Alcuni importanti aggettivi

marini

non marini

recenti

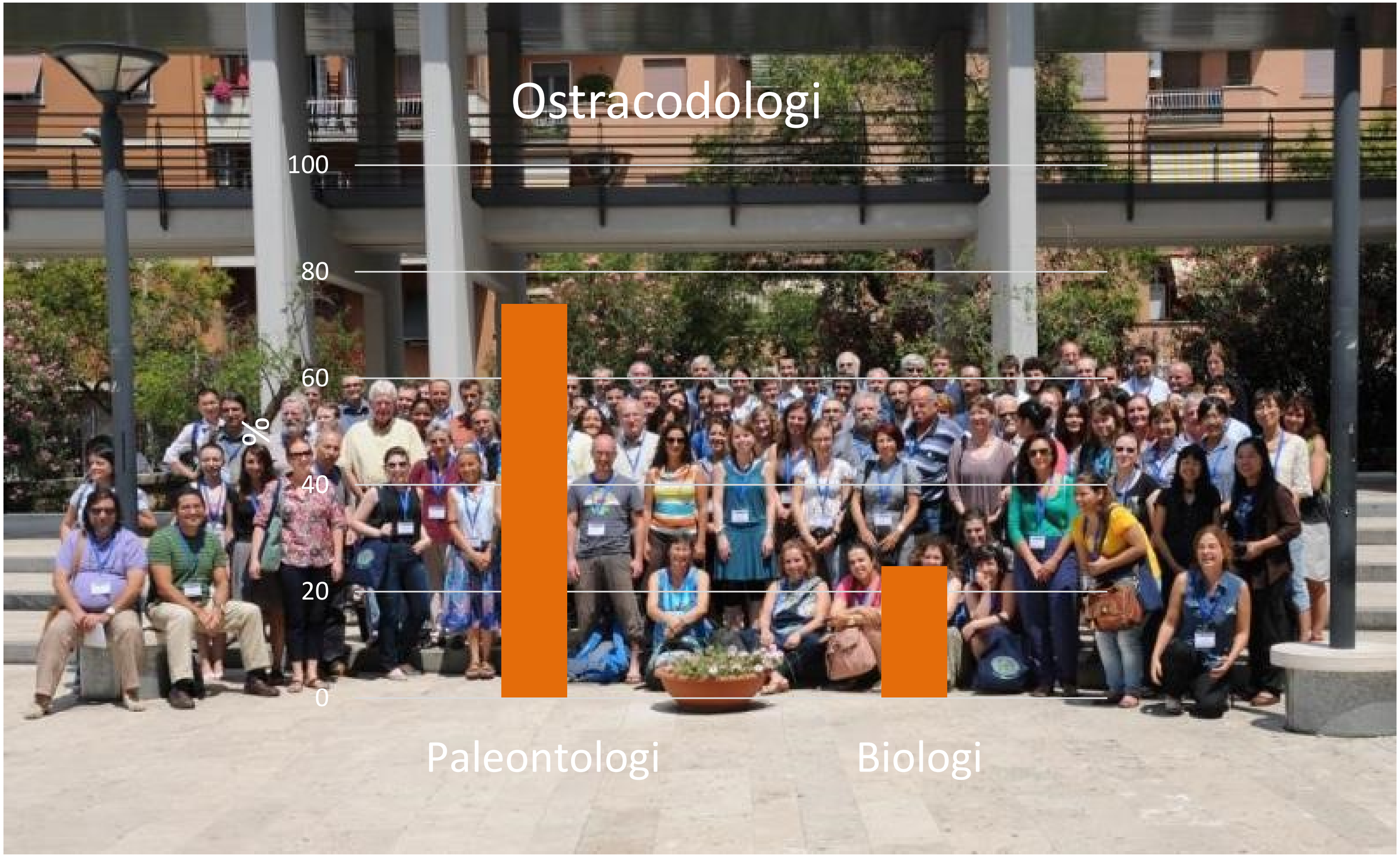
fossili

Alcuni importanti aggettivi

non marini

recenti

Chi sono e cosa fanno gli ostracodologi?



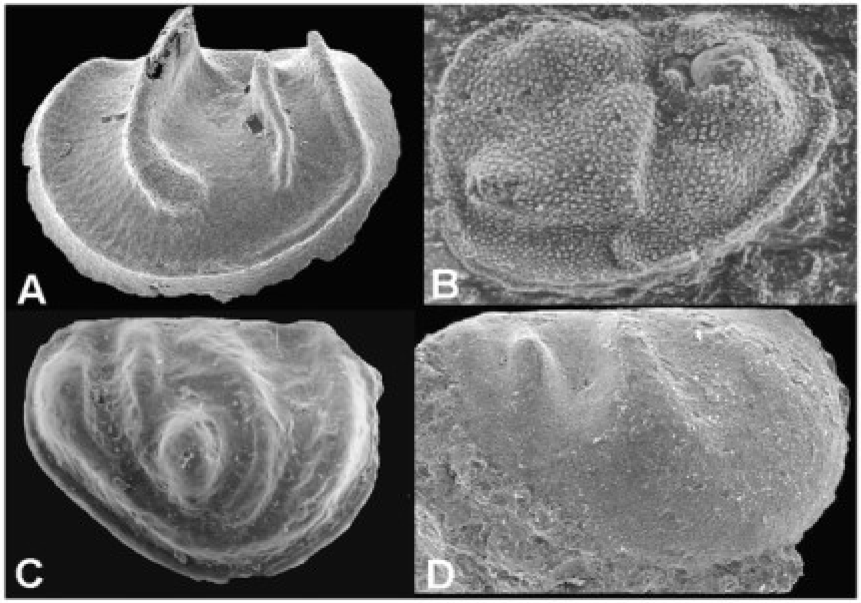
Ostracodi fossili

Affioramento di Punta Mazza (Capo Milazzo, Sicilia)

Pliocene superiore – Pleistocene

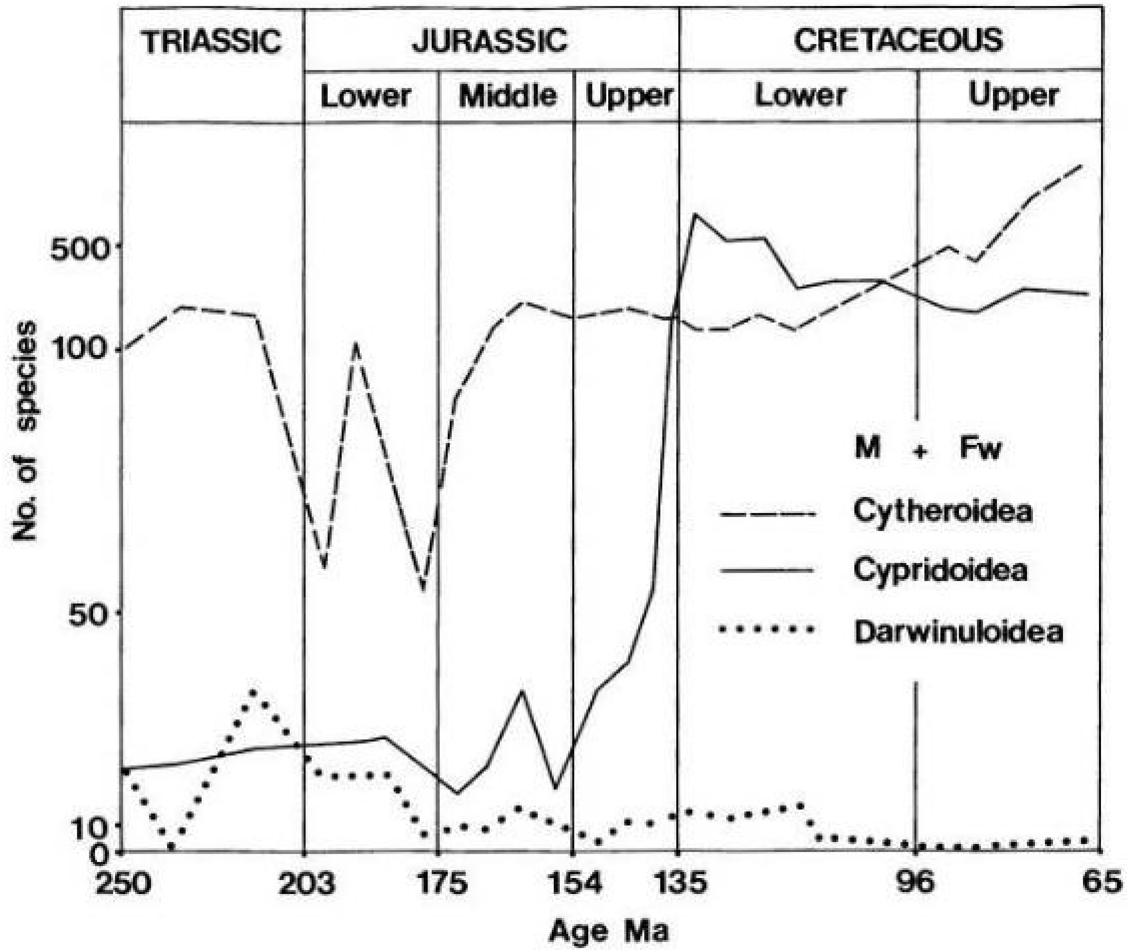
Ostracodi primitivi del Cambriano e dell'Ordoviciano

Organismi simili a ostracodi (artropodi bivalvi) sono già presenti nel Cambriano (541–485 Ma), ma non è del tutto certo che possano essere classificati come ostracodi. Forme di Myocopida e Podocopida compaiono dall'Ordoviciano. Tutte queste forme primitive sono marine, mentre le prime forme dulcicole (Darwinulacea e Carbonita) compaiono nel Carbonifero e diventano comuni negli ecosistemi di acque interne. Tra Siluriano/Devoniano e il presente ci sono grosse lacune nella documentazione fossile delle forme marine planctoniche; si pensa che questo dipenda dalla scarsa calcificazione del carapace.



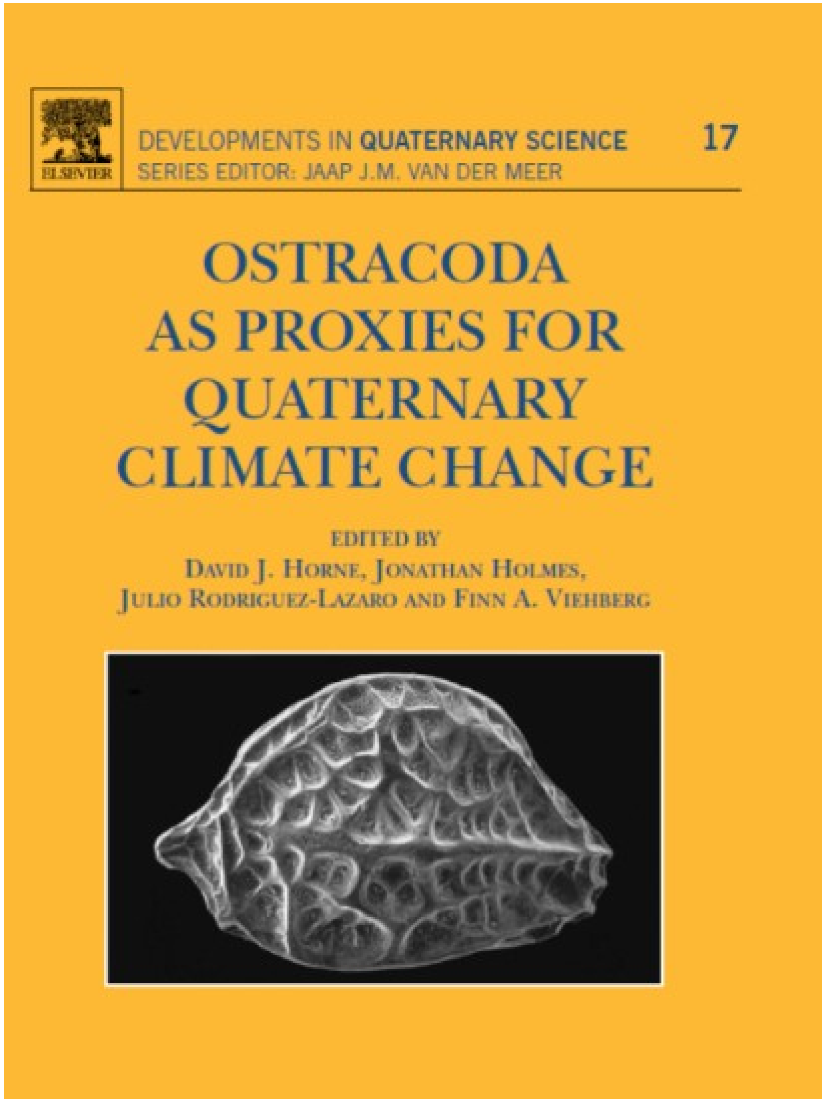
Williams *et al.*, 2011

Grande radiazione evolutiva dei Cypridoidea durante il Giurassico superiore/Cretaceo inferiore



Wathley, 1992

Ricostruzioni climatiche



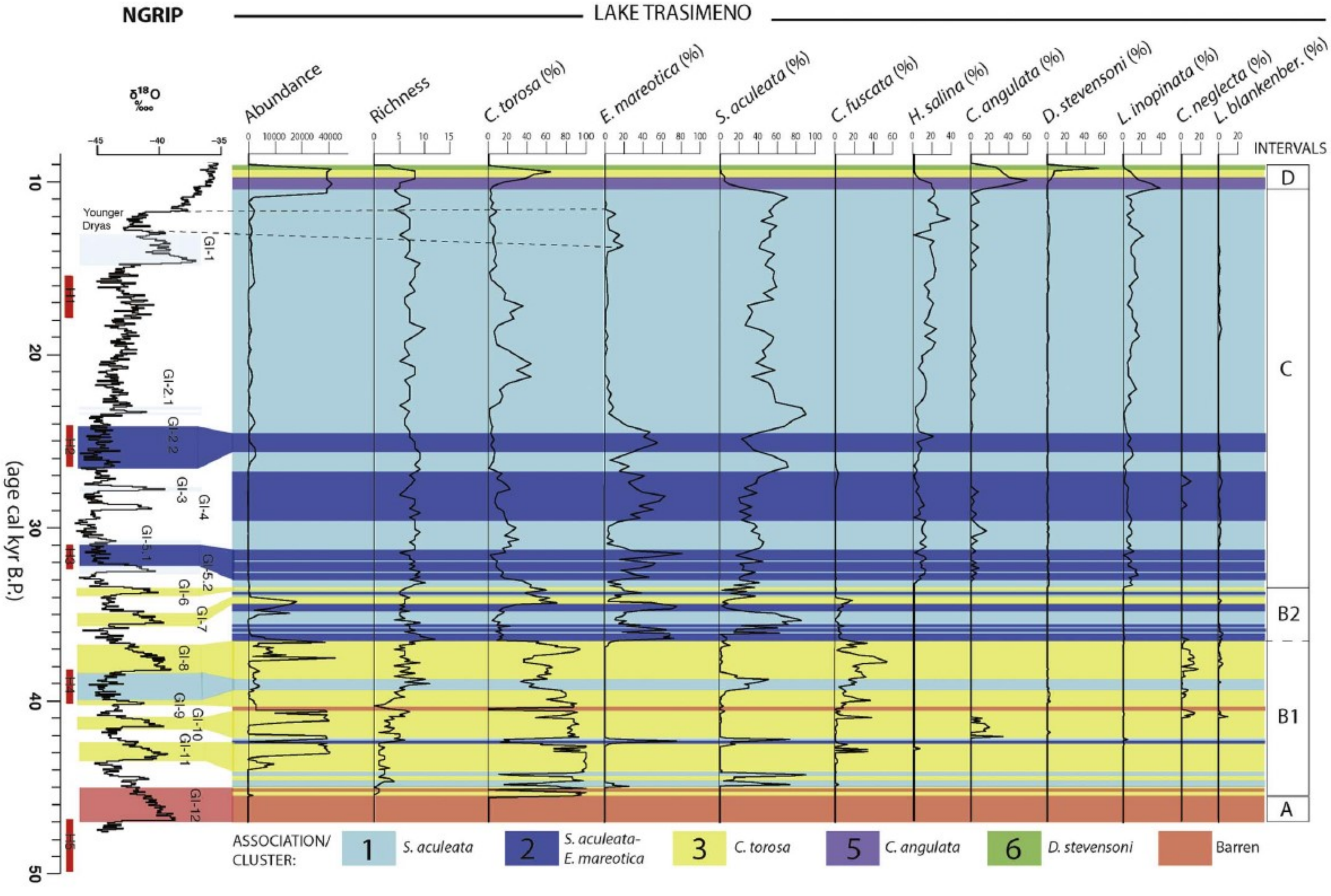
DEVELOPMENTS IN **QUATERNARY SCIENCE** 17
SERIES EDITOR: JAAP J.M. VAN DER MEER

ELSEVIER

OSTRACODA
AS PROXIES FOR
QUATERNARY
CLIMATE CHANGE

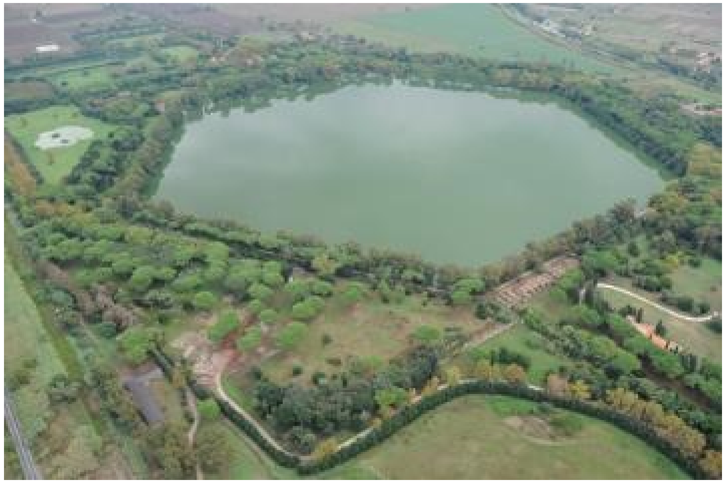
EDITED BY
DAVID J. HORNE, JONATHAN HOLMES,
JULIO RODRIGUEZ-LAZARO AND FINN A. VIEHBERG

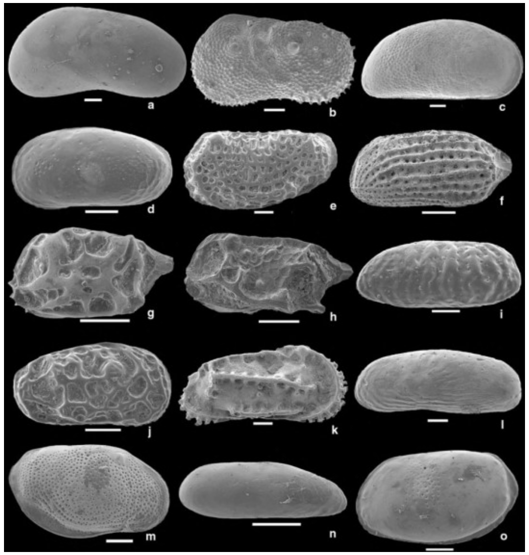
Indicatori paleo-ambientali

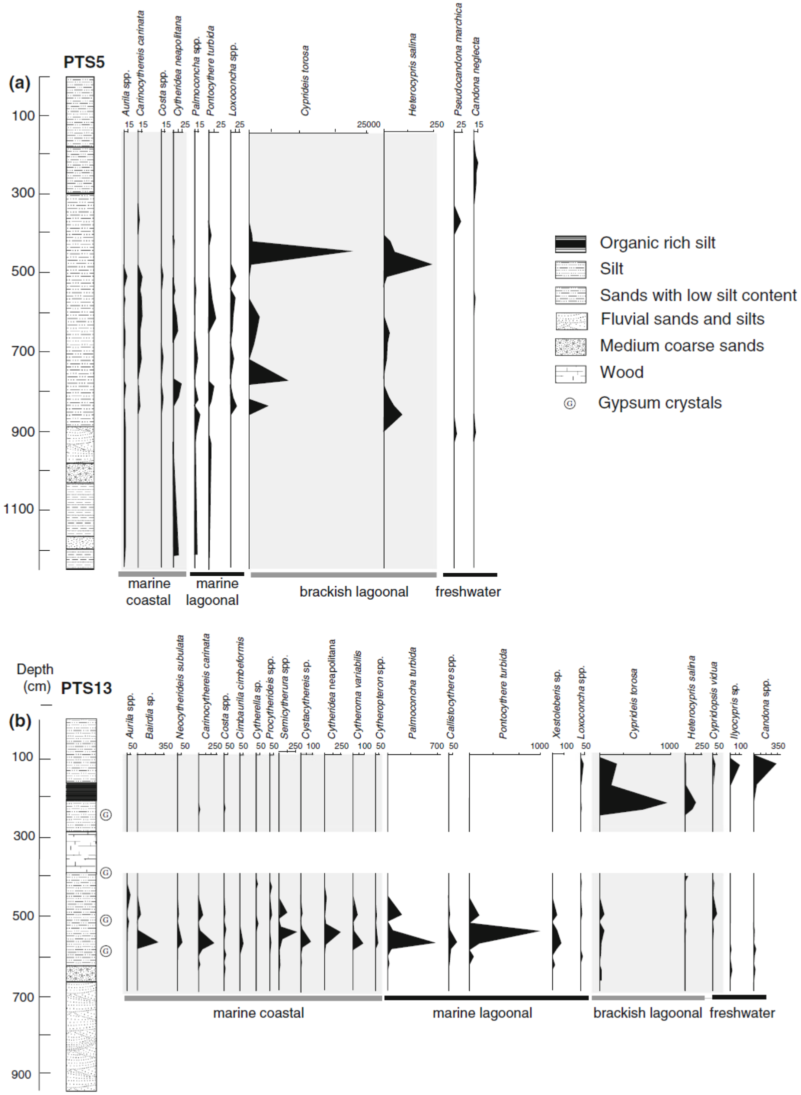


Marchegiano *et al.*, 2018

Portus, antico porto di Roma fatto costruire da Traiano (110-114 d.C.)

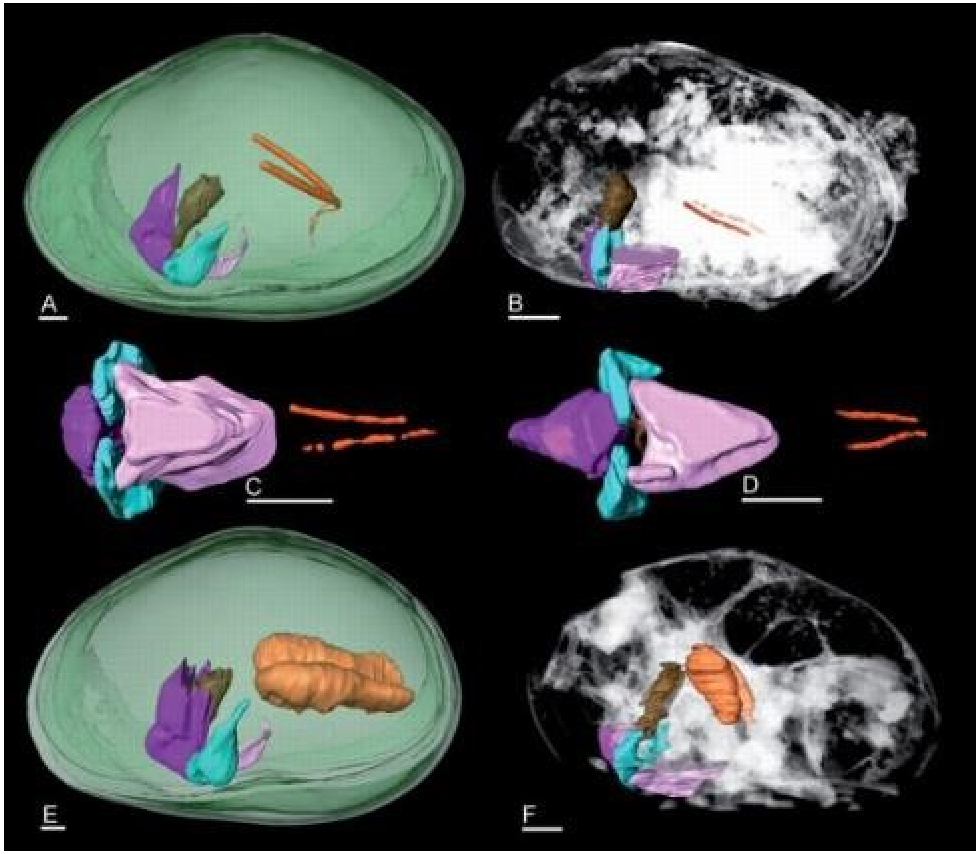






Mazzini *et al.*, 2011

Olotomografia di ostracodi usando il sincrotrone

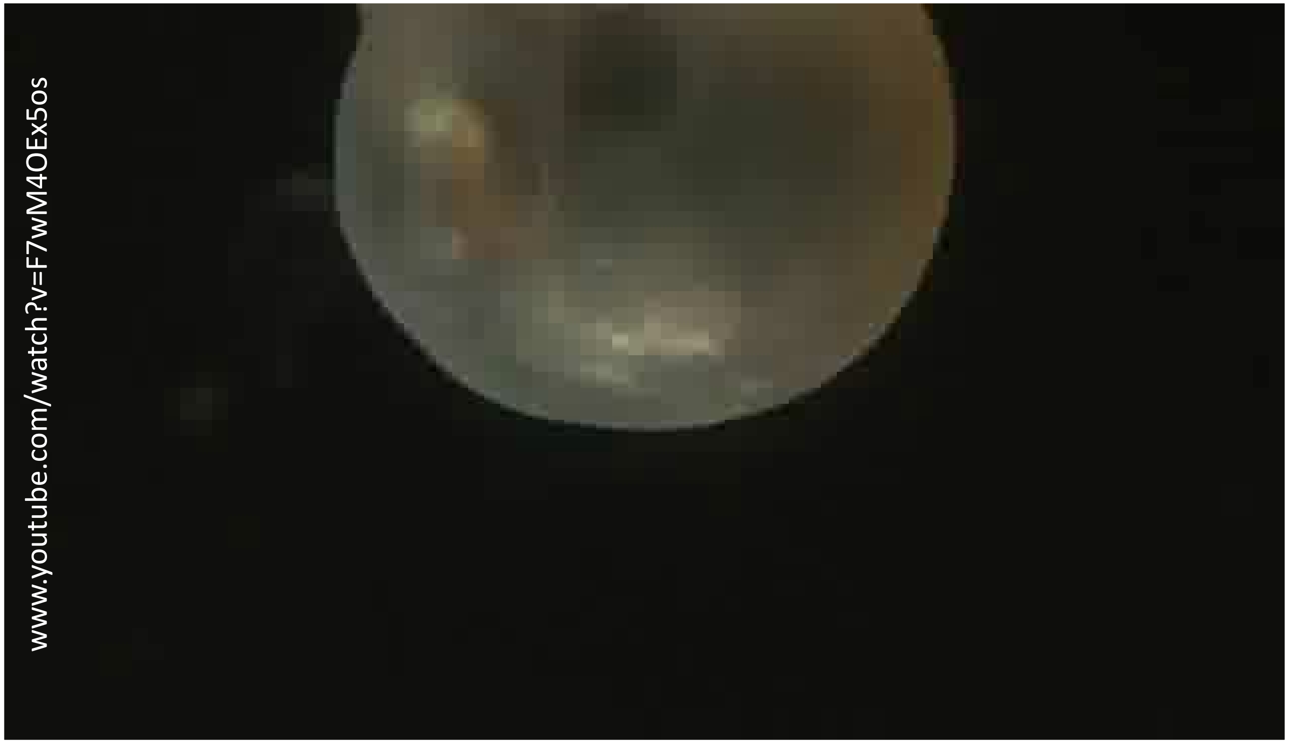


I maschi di *Harbinia micropapillosa* hanno strutture tubulari appaiate nella parte posteriore del corpo che suggeriscono la presenza di organi di Zenker, mentre le femmine mostrano cavità appaiate in prossimità della parte centrale del corpo, che corrispondono ai recettacoli seminali nei Cyprididae recenti e che sono note solo per ostracodi che si riproducono con spermatozoi giganti.

A, E: *Eucypris virens* (recente)
B-D, F*: Harbinia micropapillosa* (Formazione di Santana - Brasile - Inizio del periodo Cretaceo, c.ca 100 Ma)

Matzke-Karasz *et al*., 2011

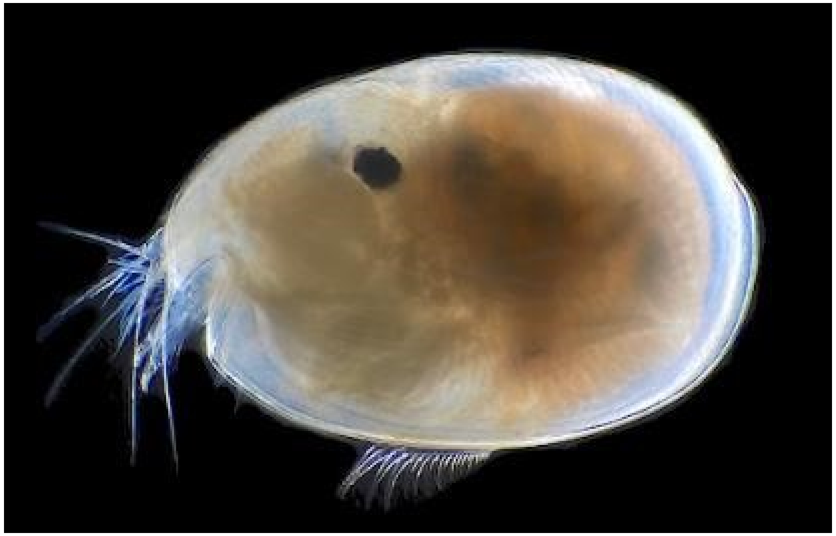
Un esempio di ostracode marino gigante



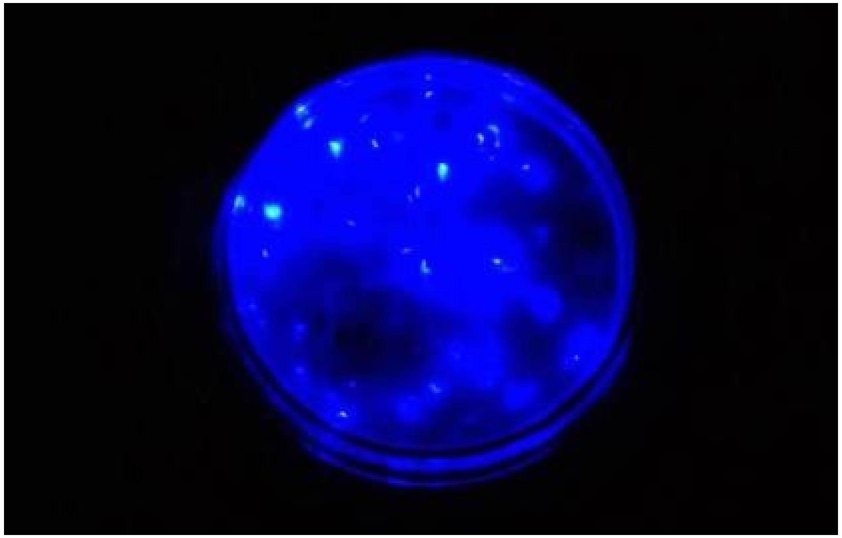
www.youtube.com/watch?v=F7wM4OEx5os

Gigantocypris sp., ostracode marino di circa 3 cm trovato nella fossa di San Clemente in California

Un esempio di ostracode marino bioluminescente



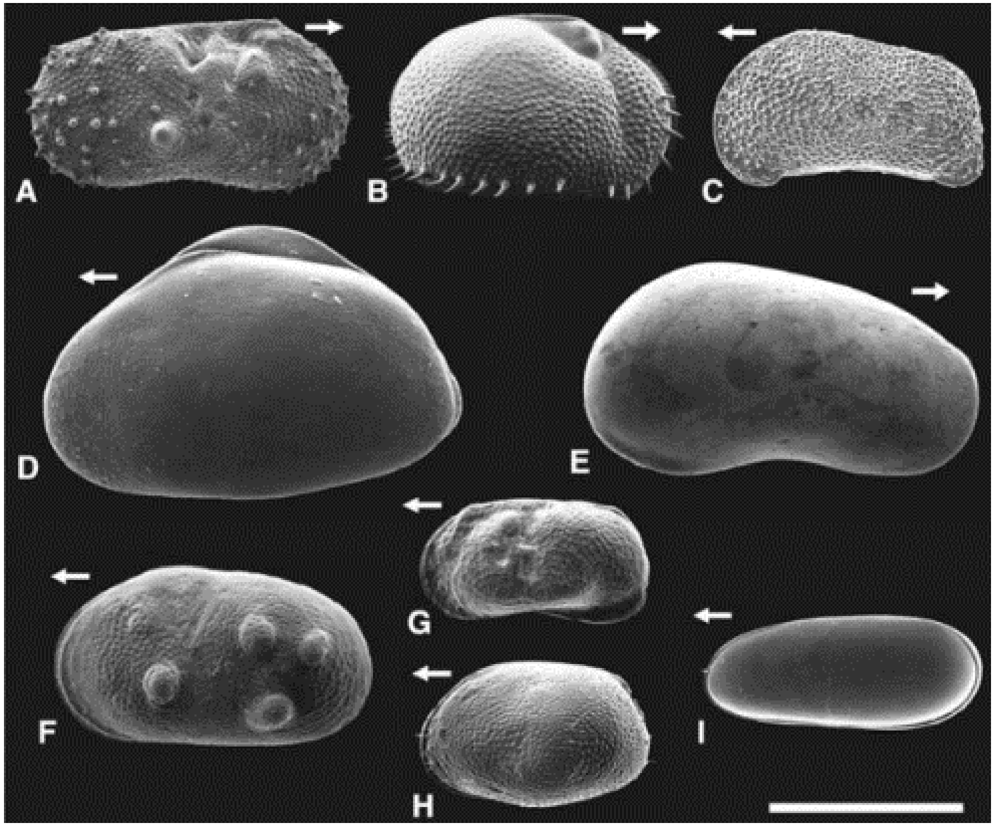
Femmina di *Vargula* sp.
(lunghezza circa 2.4 mm).



Bioluminescenza prodotta
da *Vargula* all'interno di una
piastra di Petri.

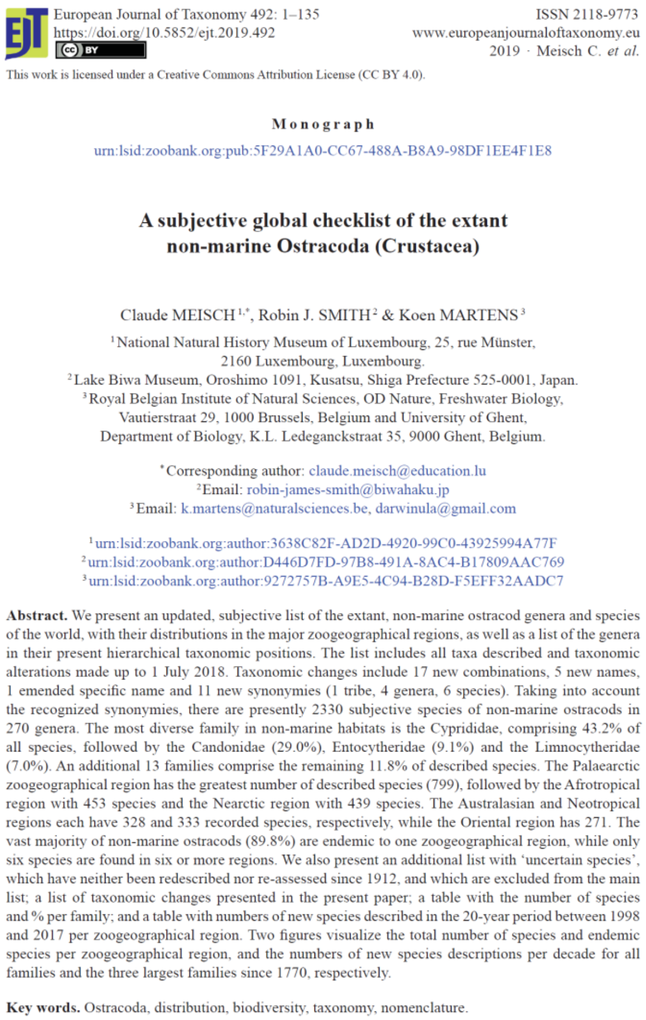
https://www.biwahaku.jp/smith/facts.html#2

Ostracodi non marini



Vista esterna del carapace di rappresentanti recenti dell'ordine Podocopida. A, *Ilyocypris* (Ilyocyprididae, Cypridoidea); B, *Centrocypris* (Notodromadidae, Cypridoidea); C, *Potamocypris* (Cyprididae, Cypridoidea); D, *Cyprinotus* (Cyprididae, Cypridoidea); E, *Candona* (Candonidae, Cypridoidea); F, *Cyprideis* (Cytherideidae, Cytheroidea); G, *Limnocythere* (Limnocytheridae, Cytheroidea); H, *Metacypris* (Limnocytheridae, Cytheroidea); I, *Darwinula* (Darwinulidae, Darwinuloidea). Scala = 0.5 mm. Da Martens *et al.*, 2008.

Diversità globale degli ostracodi non marini



European Journal of Taxonomy 492: 1–135
https://doi.org/10.5852/ejt.2019.492
ISSN 2118-9773
www.europeanjournaloftaxonomy.eu
2019 · Meisch C. *et al.*

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Monograph

urn:lsid:zoobank.org:pub:5F29A1A0-CC67-488A-B8A9-98DF1EE4F1E8

A subjective global checklist of the extant non-marine Ostracoda (Crustacea)

Claude MEISCH[1,*], Robin J. SMITH[2] & Koen MARTENS[3]

[1]National Natural History Museum of Luxembourg, 25, rue Münster, 2160 Luxembourg, Luxembourg.
[2]Lake Biwa Museum, Oroshimo 1091, Kusatsu, Shiga Prefecture 525-0001, Japan.
[3]Royal Belgian Institute of Natural Sciences, OD Nature, Freshwater Biology, Vautierstraat 29, 1000 Brussels, Belgium and University of Ghent, Department of Biology, K.L. Ledeganckstraat 35, 9000 Ghent, Belgium.

[*]Corresponding author: claude.meisch@education.lu
[2]Email: robin-james-smith@biwahaku.jp
[3]Email: k.martens@naturalsciences.be, darwinula@gmail.com

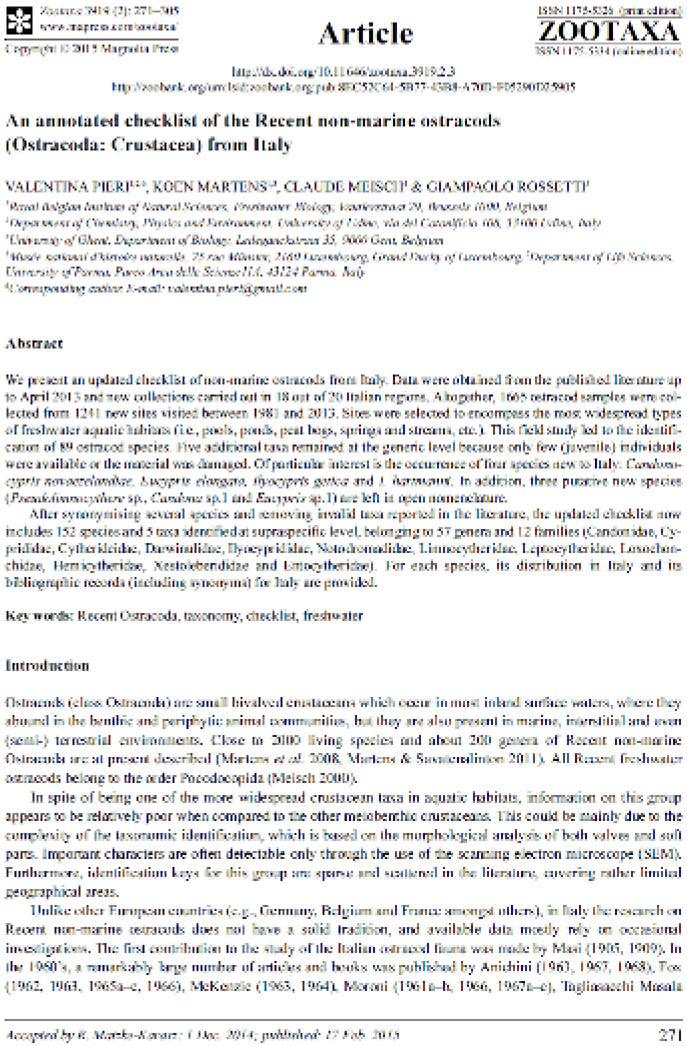
[1]urn:lsid:zoobank.org:author:3638C82F-AD2D-4920-99C0-43925994A77F
[2]urn:lsid:zoobank.org:author:D446D7FD-97B8-491A-8AC4-B17809AAC769
[3]urn:lsid:zoobank.org:author:9272757B-A9E5-4C94-B28D-F5EFF32AADC7

Abstract. We present an updated, subjective list of the extant, non-marine ostracod genera and species of the world, with their distributions in the major zoogeographical regions, as well as a list of the genera in their present hierarchical taxonomic positions. The list includes all taxa described and taxonomic alterations made up to 1 July 2018. Taxonomic changes include 17 new combinations, 5 new names, 1 emended specific name and 11 new synonymies (1 tribe, 4 genera, 6 species). Taking into account the recognized synonymies, there are presently 2330 subjective species of non-marine ostracods in 270 genera. The most diverse family in non-marine habitats is the Cyprididae, comprising 43.2% of all species, followed by the Candonidae (29.0%), Entocytheridae (9.1%) and the Limnocytheridae (7.0%). An additional 13 families comprise the remaining 11.8% of described species. The Palaearctic zoogeographical region has the greatest number of described species (799), followed by the Afrotropical region with 453 species and the Nearctic region with 439 species. The Australasian and Neotropical regions each have 328 and 333 recorded species, respectively, while the Oriental region has 271. The vast majority of non-marine ostracods (89.8%) are endemic to one zoogeographical region, while only six species are found in six or more regions. We also present an additional list with 'uncertain species', which have neither been redescribed nor re-assessed since 1912, and which are excluded from the main list; a list of taxonomic changes presented in the present paper; a table with the number of species and % per family; and a table with numbers of new species described in the 20-year period between 1998 and 2017 per zoogeographical region. Two figures visualize the total number of species and endemic species per zoogeographical region, and the numbers of new species descriptions per decade for all families and the three largest families since 1770, respectively.

Key words. Ostracoda, distribution, biodiversity, taxonomy, nomenclature.

…there are presently 2330 subjective species of non-marine ostracods in 270 genera.

Diversità degli ostracodi non marini in Italia



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Article

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An annotated checklist of the Recent non-marine ostracods (Ostracoda: Crustacea) from Italy

VALENTINA PIERI[1,5,6], KOEN MARTENS[1,3], CLAUDE MEISCH[4] & GIAMPAOLO ROSSETTI[5]
[1]*Royal Belgian Institute of Natural Sciences, Freshwater Biology, Vautierstraat 29, Brussels 1000, Belgium*
[2]*Department of Chemistry, Physics and Environment, University of Udine, via del Cotonificio 108, 33100 Udine, Italy*
[3]*University of Ghent, Department of Biology, Ledeganckstraat 35, 9000 Gent, Belgium*
[4]*Musée national d'histoire naturelle, 25 rue Münster, 2160 Luxembourg, Grand Duchy of Luxembourg* [5]*Department of Life Sciences, University of Parma, Parco Area delle Scienze 11A, 43124 Parma, Italy*
[6]*Corresponding author. E-mail: valentina.pieri@gmail.com*

Abstract

We present an updated checklist of non-marine ostracods from Italy. Data were obtained from the published literature up to April 2013 and new collections carried out in 18 out of 20 Italian regions. Altogether, 1665 ostracod samples were collected from 1241 new sites visited between 1981 and 2013. Sites were selected to encompass the most widespread types of freshwater aquatic habitats (i.e., pools, ponds, peat bogs, springs and streams, etc.). This field study led to the identification of 89 ostracod species. Five additional taxa remained at the generic level because only few (juvenile) individuals were available or the material was damaged. Of particular interest is the occurrence of four species new to Italy: *Candonocypris novaezelandiae*, *Eucypris elongata*, *Ilyocypris getica* and *I. hartmanni*. In addition, three putative new species (*Pseudolimnocythere* sp., *Candona* sp.1 and *Eucypris* sp.1) are left in open nomenclature.

After synonymising several species and removing invalid taxa reported in the literature, the updated checklist now includes 152 species and 5 taxa identified at supraspecific level, belonging to 57 genera and 12 families (Candonidae, Cyprididae, Cytherideidae, Darwinulidae, Ilyocyprididae, Notodromadidae, Limnocytheridae, Leptocytheridae, Loxoconchidae, Hemicytheridae, Xestoleberididae and Entocytheridae). For each species, its distribution in Italy and its bibliographic records (including synonyms) for Italy are provided.

Key words: Recent Ostracoda, taxonomy, checklist, freshwater

Introduction

Ostracods (class Ostracoda) are small bivalved crustaceans which occur in most inland surface waters, where they abound in the benthic and periphytic animal communities, but they are also present in marine, interstitial and even (semi-) terrestrial environments. Close to 2000 living species and about 200 genera of Recent non-marine Ostracoda are at present described (Martens *et al.* 2008, Martens & Savatenalinton 2011). All Recent freshwater ostracods belong to the order Podocopida (Meisch 2000).

In spite of being one of the more widespread crustacean taxa in aquatic habitats, information on this group appears to be relatively poor when compared to the other meiobenthic crustaceans. This could be mainly due to the complexity of the taxonomic identification, which is based on the morphological analysis of both valves and soft parts. Important characters are often detectable only through the use of the scanning electron microscope (SEM). Furthermore, identification keys for this group are sparse and scattered in the literature, covering rather limited geographical areas.

Unlike other European countries (e.g., Germany, Belgium and France amongst others), in Italy the research on Recent non-marine ostracods does not have a solid tradition, and available data mostly rely on occasional investigations. The first contribution to the study of the Italian ostracod fauna was made by Masi (1905, 1909). In the 1960's, a remarkably large number of articles and books was published by Anichini (1963, 1967, 1968), Fox (1962, 1963, 1965a–c, 1966), McKenzie (1963, 1964), Moroni (1961a–h, 1966, 1967a–c), Tagliasacchi Masala

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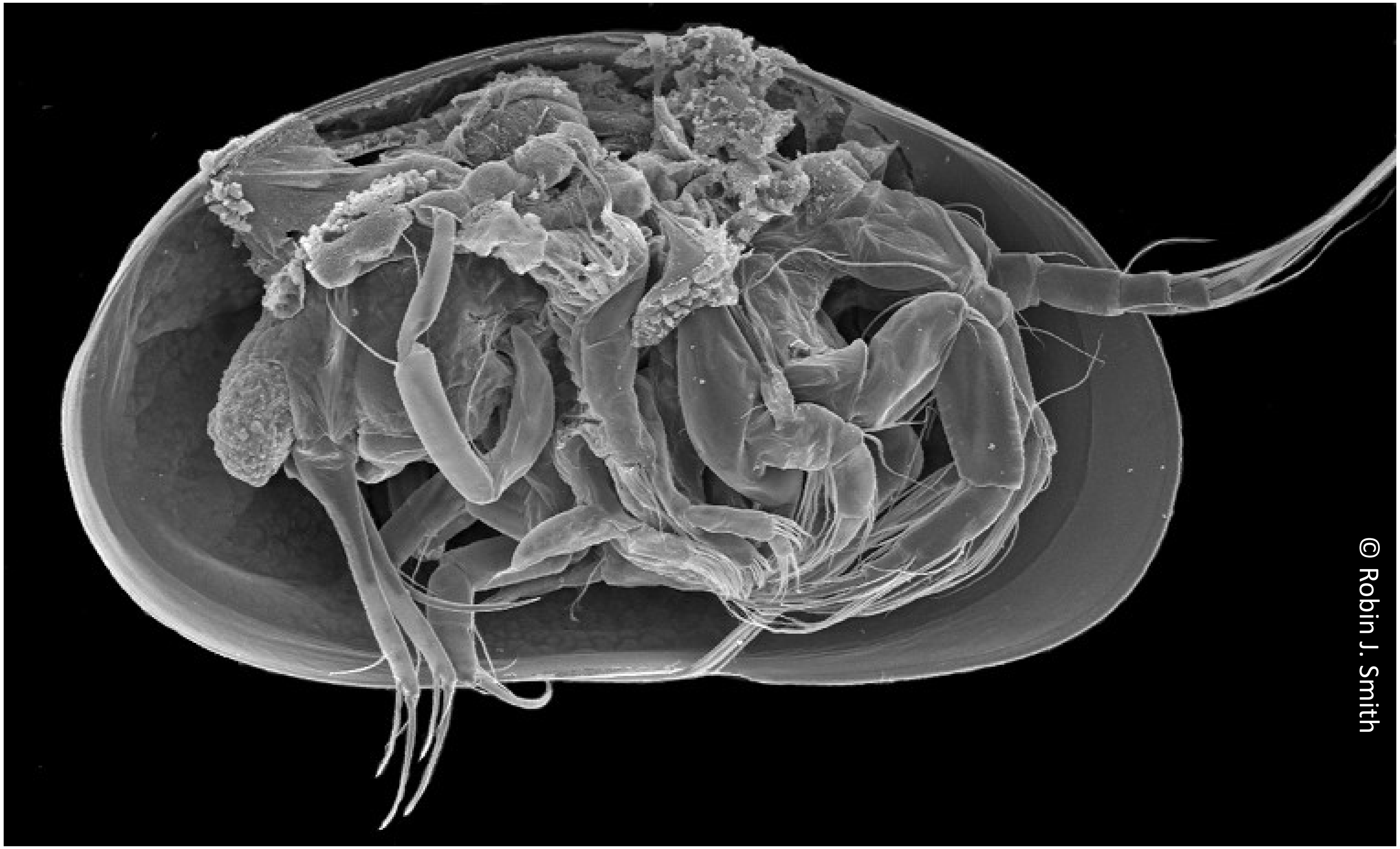
Accepted by R. Matzke-Karasz: 1 Dec. 2014; published: 17 Feb. 2015

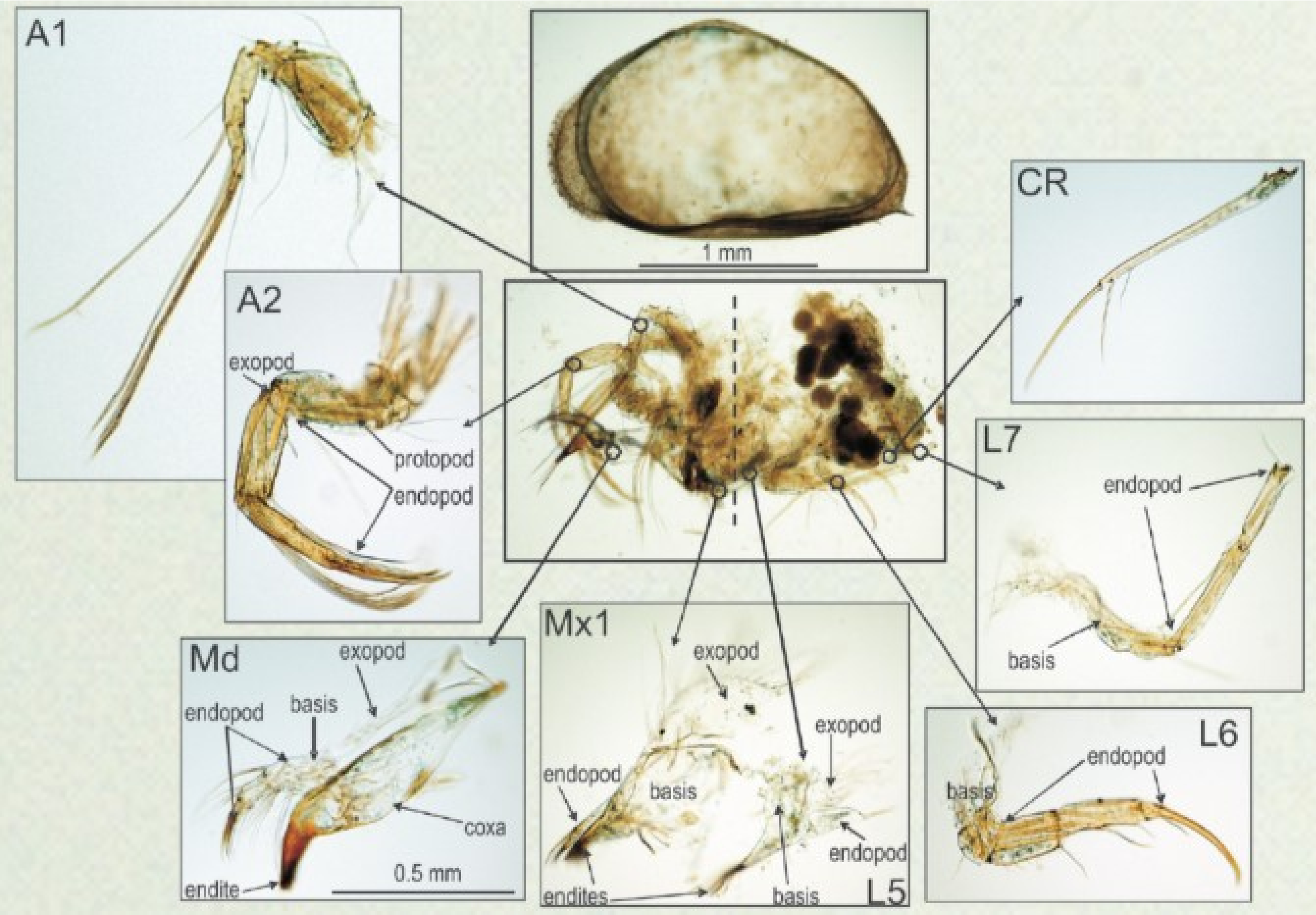
…the updated checklist now includes 152 species and 5 taxa identified at supraspecific level, belonging to 57 genera…

Qualche dettaglio in più sulla morfologia


© Robin J. Smith

Femmina adulta di *Heterocypris incongruens* (Ramdohr, 1808).

Qualche dettaglio in più sulla morfologia


A1
1 mm
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L7
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basis
Md
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Mx1
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exopod
endopod
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endopod
endites
basis
L5
L6
endopod
basis

Morfologia di una femmina di *Cypris pubera* O.F. Müller come esempio di un ostracode dell’ordine Podocopida. Da Namiotko *et al*., 2011.

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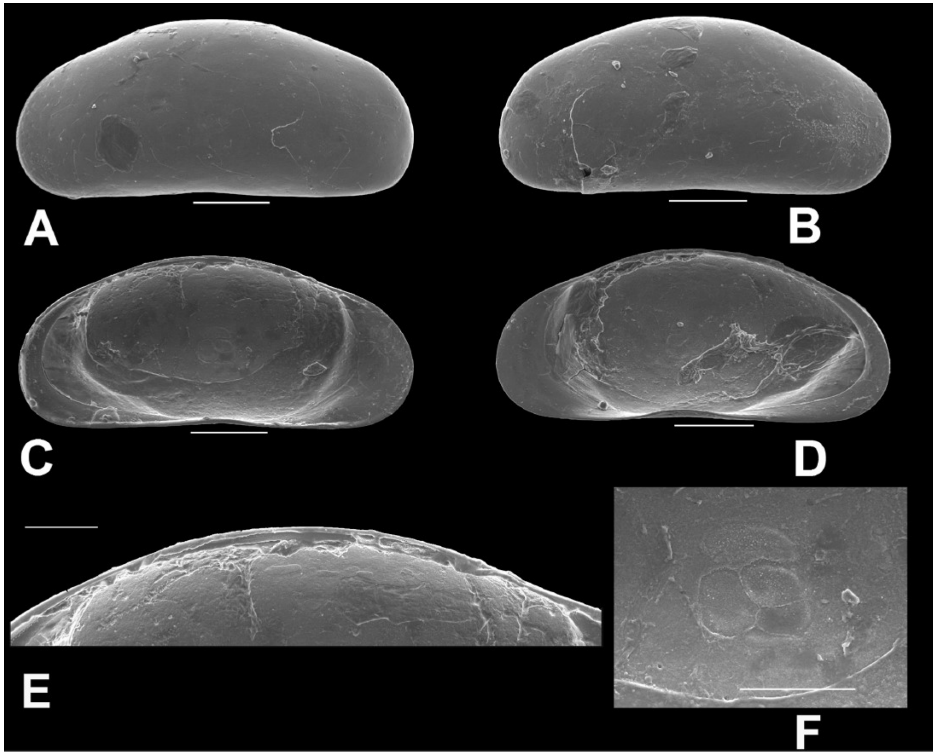
Dove vivono gli ostracodi non marini?

Dove vivono gli ostracodi non marini?

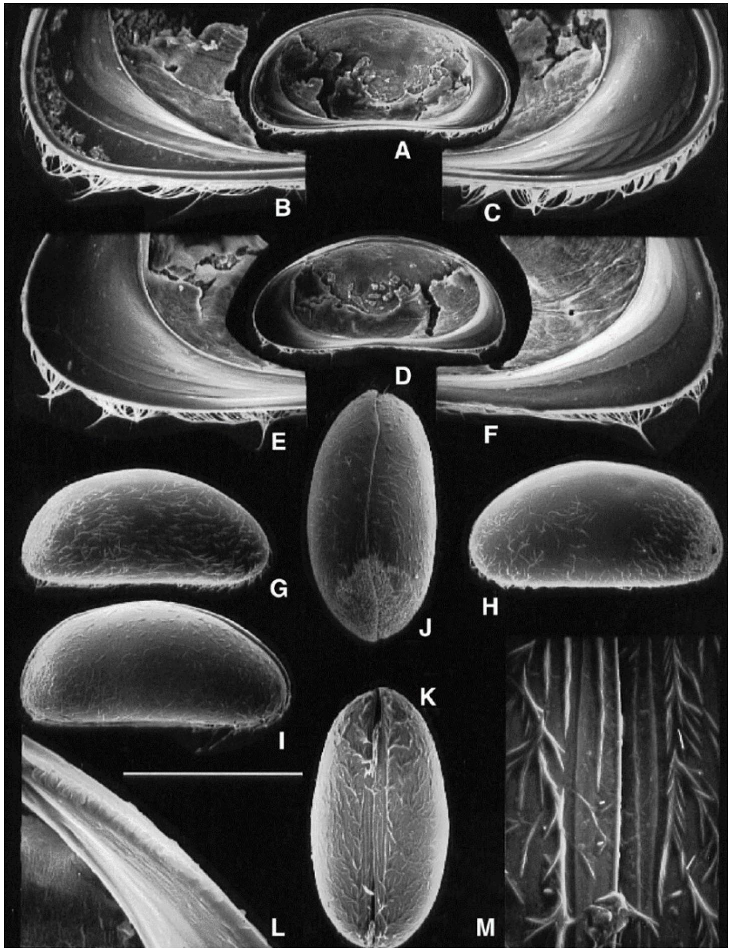


Mixtacandona idrisi

Grotta Molara

Mazzini *et al.*, 2017

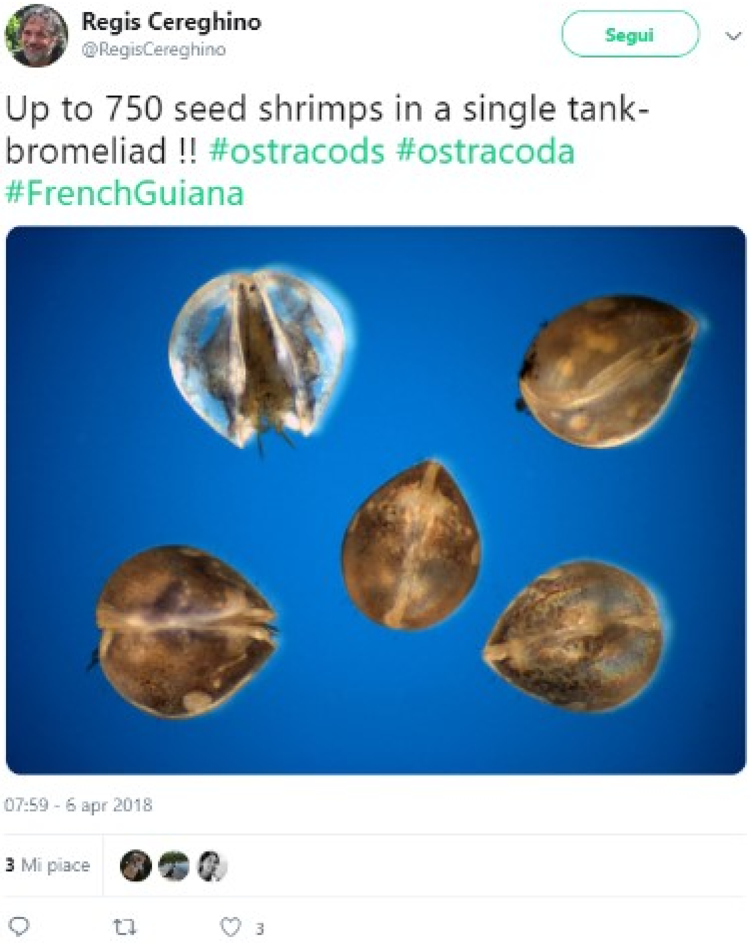
Dove vivono gli ostracodi non marini?



Austromesocypris berentsae

Martens *et al.*, 2004

Dove vivono gli ostracodi non marini?



Regis Cereghino
@RegisCereghino

Up to 750 seed shrimps in a single tank-bromeliad !! #ostracods #ostracoda #FrenchGuiana

07:59 - 6 apr 2018

3 Mi piace

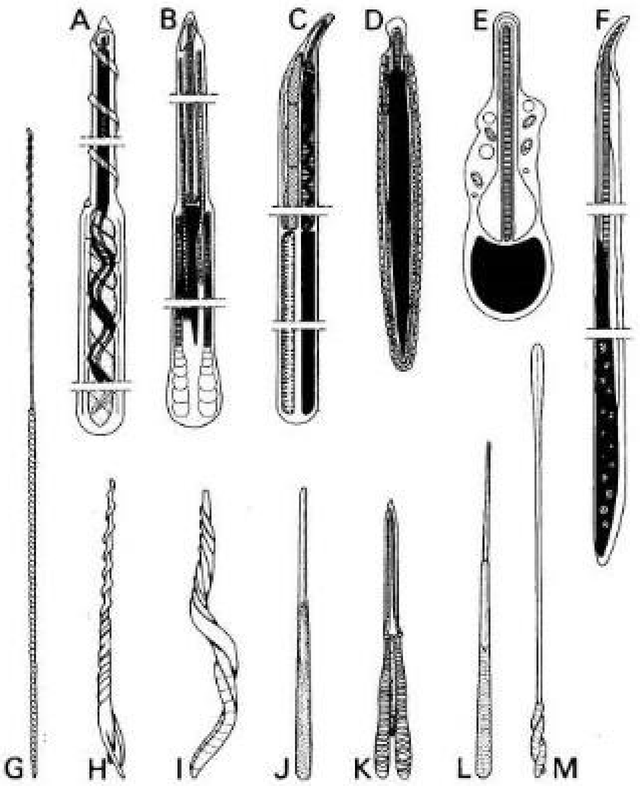
Cosa mangiano gli ostracodi non marini?

Courtesy D. J. Horne

Cypris pubera

Gli ostracodi non marini sono prevalentemente detritivori, ma sono documentati casi di cannibalismo e di predazione.

Spermatozoi giganti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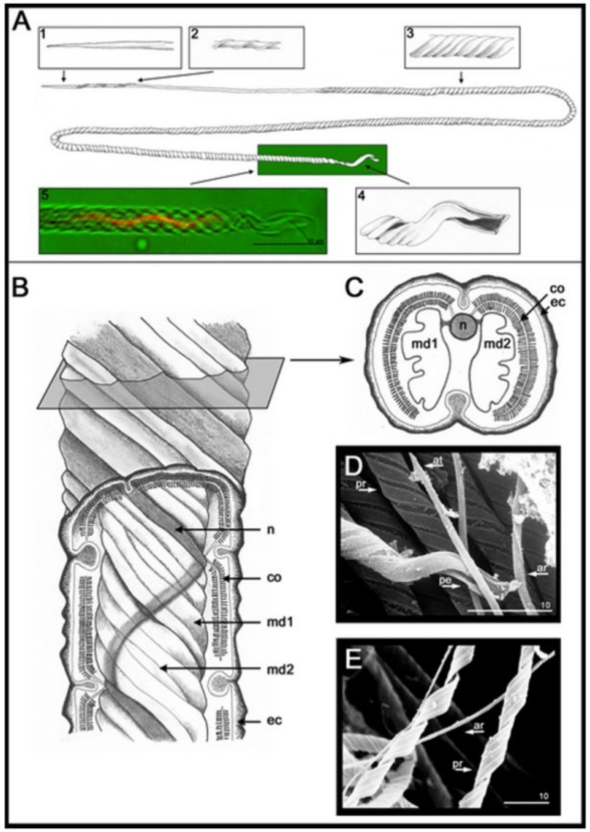
Principali tipi di spermatozoi in ostracodi non marini (Schön & Martens, 1998).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E
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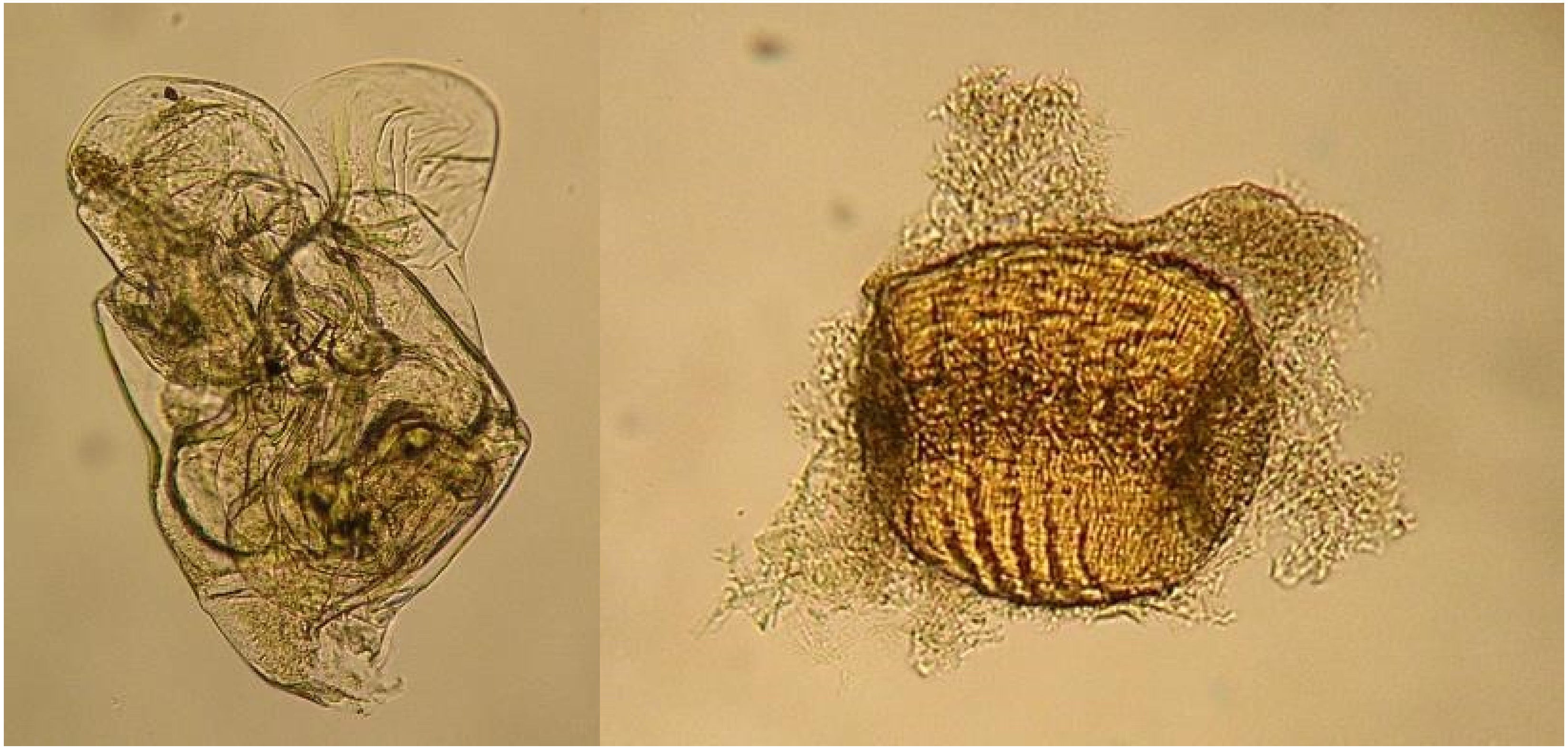
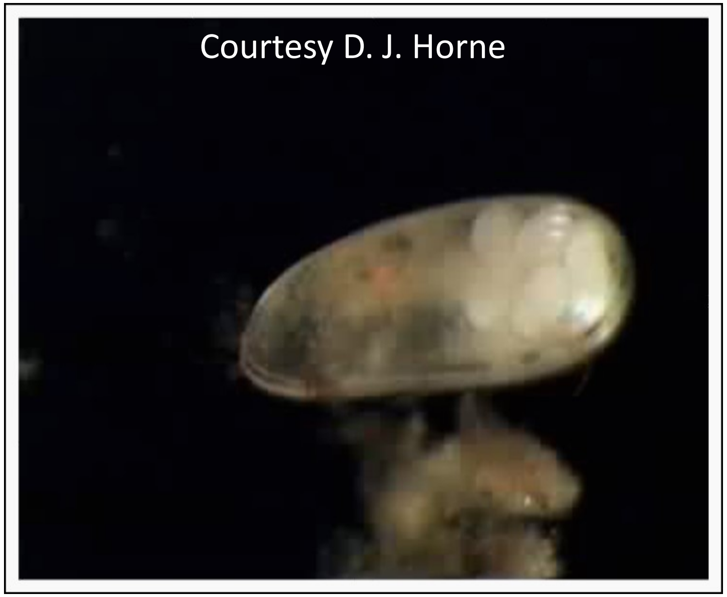
10

Rappresentazione schematica degli spermatozoi di *Mytilocypris praenuncia* (Matzke-Karasz, 2005).

Emipene e organo di Zenker di *Pseudocandona rostrata*



Famiglia Darwinulidae: almeno 200 milioni di anni senza sesso

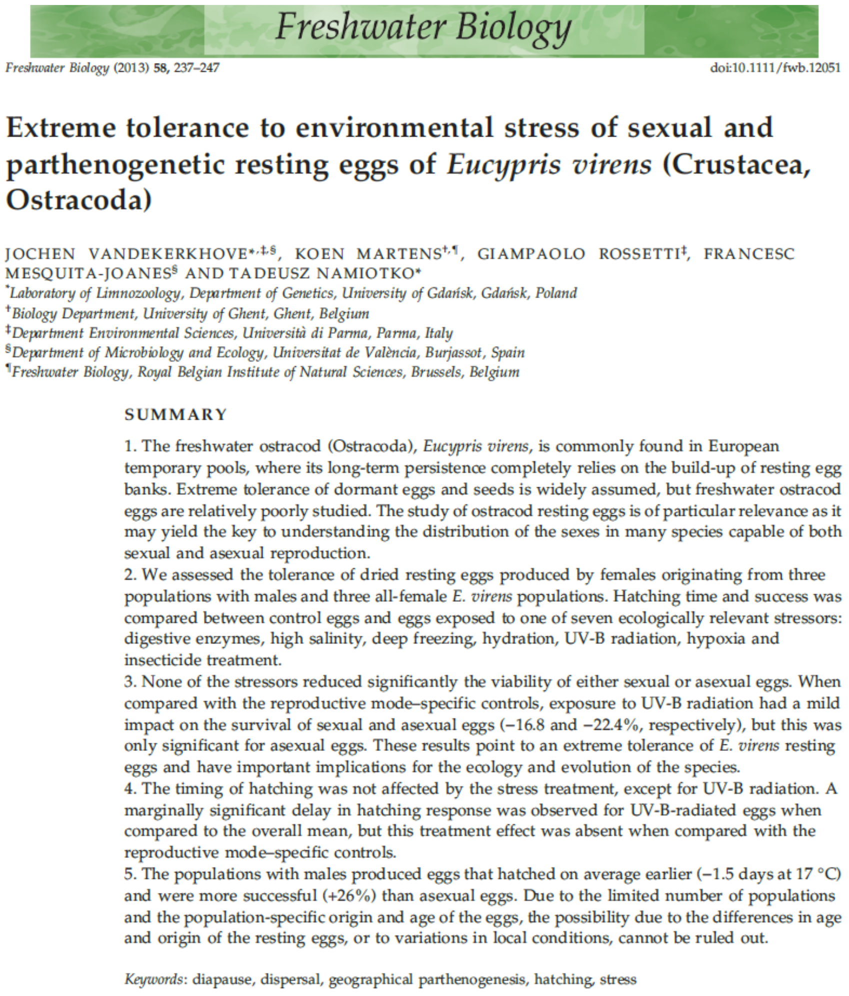

Courtesy D. J. Horne

Darwinula stevensoni

Questa famiglia, la sola ancora esistente della superfamiglia Darwinuloidea, rappresenta circa il 5% della diversità specifica totale dell'ostracofauna non marina ed è considerato essere uno dei pochissimi gruppi di “ancient asexuals” tra i metazoi.

UNA MONTAGNA DI VITA
Ecosistemi d'alta quota e cambiamenti climatici

Le uova più resistenti al mondo?



Freshwater Biology

Freshwater Biology (2013) **58**, 237–247 doi:10.1111/fwb.12051

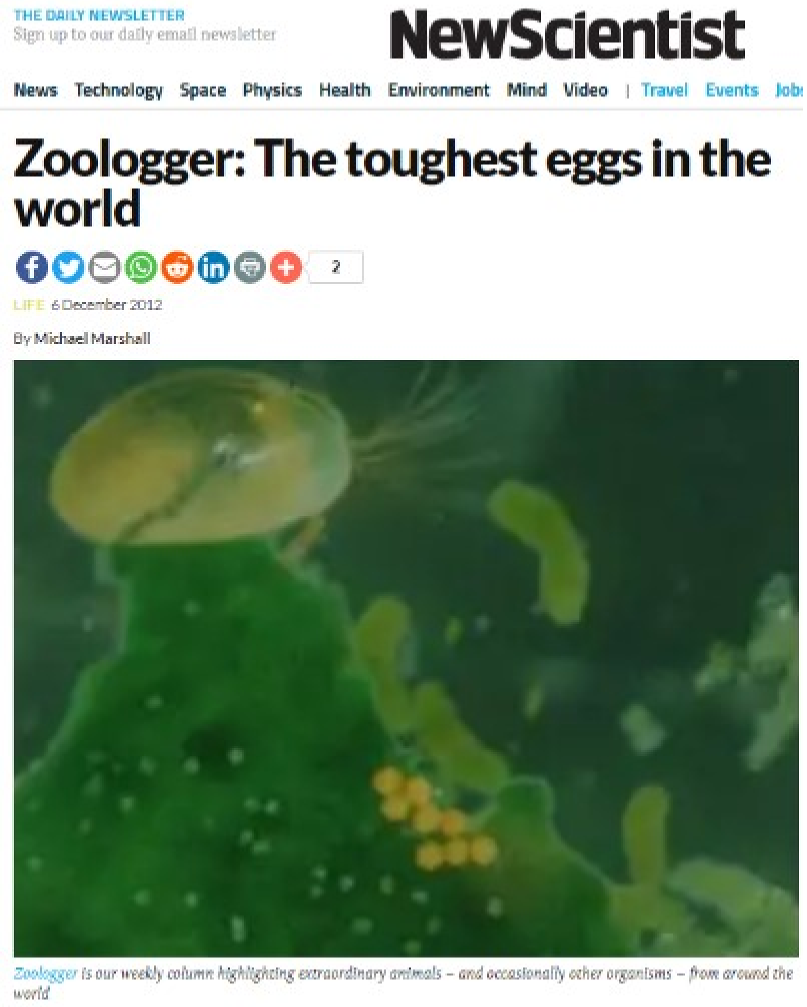
Extreme tolerance to environmental stress of sexual and parthenogenetic resting eggs of *Eucypris virens* (Crustacea, Ostracoda)

JOCHEN VANDEKERKHOVE[*,‡,§], KOEN MARTENS[†,¶], GIAMPAOLO ROSSETTI[‡], FRANCESC MESQUITA-JOANES[§] AND TADEUSZ NAMIOTKO[*]
[*] *Laboratory of Limnozoology, Department of Genetics, University of Gdańsk, Gdańsk, Poland*
[†] *Biology Department, University of Ghent, Ghent, Belgium*
[‡] *Department Environmental Sciences, Università di Parma, Parma, Italy*
[§] *Department of Microbiology and Ecology, Universitat de València, Burjassot, Spain*
[¶] *Freshwater Biology, Royal Belgian Institute of Natural Sciences, Brussels, Belgium*

SUMMARY

1. The freshwater ostracod (Ostracoda), *Eucypris virens*, is commonly found in European temporary pools, where its long-term persistence completely relies on the build-up of resting egg banks. Extreme tolerance of dormant eggs and seeds is widely assumed, but freshwater ostracod eggs are relatively poorly studied. The study of ostracod resting eggs is of particular relevance as it may yield the key to understanding the distribution of the sexes in many species capable of both sexual and asexual reproduction.
2. We assessed the tolerance of dried resting eggs produced by females originating from three populations with males and three all-female *E. virens* populations. Hatching time and success was compared between control eggs and eggs exposed to one of seven ecologically relevant stressors: digestive enzymes, high salinity, deep freezing, hydration, UV-B radiation, hypoxia and insecticide treatment.
3. None of the stressors reduced significantly the viability of either sexual or asexual eggs. When compared with the reproductive mode–specific controls, exposure to UV-B radiation had a mild impact on the survival of sexual and asexual eggs (−16.8 and −22.4%, respectively), but this was only significant for asexual eggs. These results point to an extreme tolerance of *E. virens* resting eggs and have important implications for the ecology and evolution of the species.
4. The timing of hatching was not affected by the stress treatment, except for UV-B radiation. A marginally significant delay in hatching response was observed for UV-B-radiated eggs when compared to the overall mean, but this treatment effect was absent when compared with the reproductive mode–specific controls.
5. The populations with males produced eggs that hatched on average earlier (−1.5 days at 17 °C) and were more successful (+26%) than asexual eggs. Due to the limited number of populations and the population-specific origin and age of the eggs, the possibility due to the differences in age and origin of the resting eggs, or to variations in local conditions, cannot be ruled out.

Keywords: diapause, dispersal, geographical parthenogenesis, hatching, stress



Zoologger: The toughest eggs in the world

LIFE 6 December 2012

By Michael Marshall

Zoologger is our weekly column highlighting extraordinary animals – and occasionally other organisms – from around the world

Sorgenti: ecosistemi importanti ma fragili

- Le sorgenti sono ecosistemi acquatici unici che contribuiscono in modo significativo alla biodiversità locale e regionale a causa dell’elevata complessità del loro habitat e di **diverse tipologie di sorgenti**.
- Molte sorgenti hanno piccole dimensioni, ma sono numerose e spesso con acque di alta qualità, e quindi costituiscono l’habitat per specie che sono rare altrove a causa della loro sensibilità agli impatti antropici.
- Le sorgenti sostengono un’elevata biodiversità (organismi **crenofili** e **crenobionti**) e contengono un maggior numero di taxa inseriti in Lista Rossa rispetto ad altri ambienti acquatici.

Permanenti, temporanee, effimere.
Sorgenti minerali, *iron springs, hard water springs*…
Ambient, cold, thermal, hot springs.
Reocrene, elocrene, limnocrene.

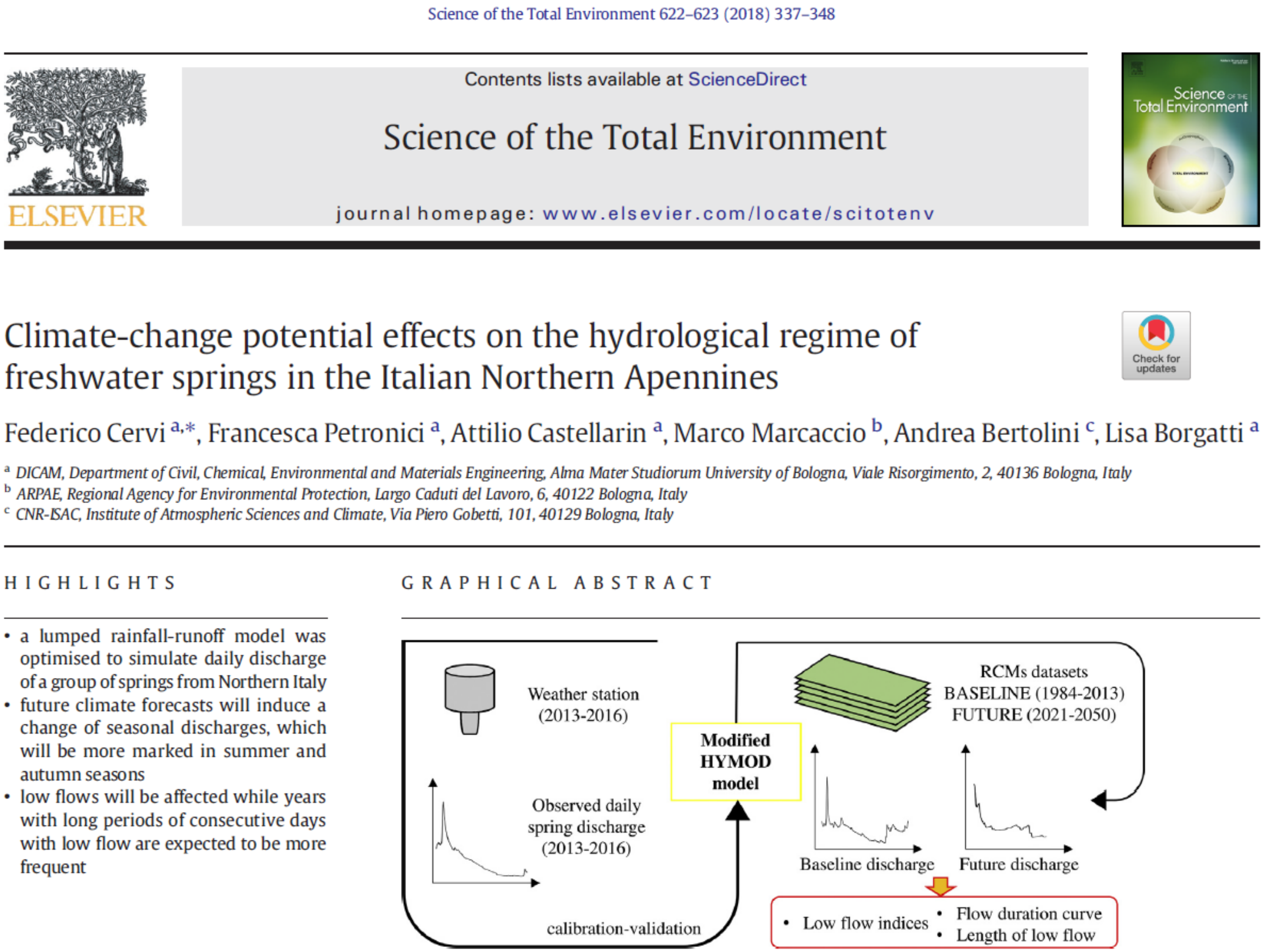
Cantonati *et al.*, 2012

Sorgenti: ecosistemi importanti ma fragili

- L'idrologia, in particolare la persistenza del flusso, la chimica dell'acqua e la temperatura sono importanti fattori ecologici che determinano la distribuzione delle specie e la composizione delle comunità sorgentizie.
- Nonostante loro importanza per la biodiversità e come risorse idriche, le sorgenti sono molto meno studiate rispetto ad altri ecosistemi acquatici.
- Sono scarsamente tutelate da un punto di vista legislativo. Ad esempio, sorgenti e piccoli bacini di testata (>10 km^2) non sono considerati nella Direttiva Quadro sulle Acque 2000/60/CE.
- Sono soggette ad impatti diretti (prelievi a fini idroelettrici e potabili, uso del suolo, arricchimento di nutrienti) e indiretti (inquinamento per ricaduta atmosferica, **cambiamento climatico**).

Cantonati *et al.*, 2012

Effetti del cambiamento climatico sulle sorgenti dell'Appennino settentrionale



Science of the Total Environment 622–623 (2018) 337–348

Contents lists available at ScienceDirect

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journal homepage: www.elsevier.com/locate/scitotenv

Climate-change potential effects on the hydrological regime of freshwater springs in the Italian Northern Apennines

Federico Cervi [a,*], Francesca Petronici [a], Attilio Castellarin [a], Marco Marcaccio [b], Andrea Bertolini [c], Lisa Borgatti [a]

[a] DICAM, Department of Civil, Chemical, Environmental and Materials Engineering, Alma Mater Studiorum University of Bologna, Viale Risorgimento, 2, 40136 Bologna, Italy
[b] ARPAE, Regional Agency for Environmental Protection, Largo Caduti del Lavoro, 6, 40122 Bologna, Italy
[c] CNR-ISAC, Institute of Atmospheric Sciences and Climate, Via Piero Gobetti, 101, 40129 Bologna, Italy

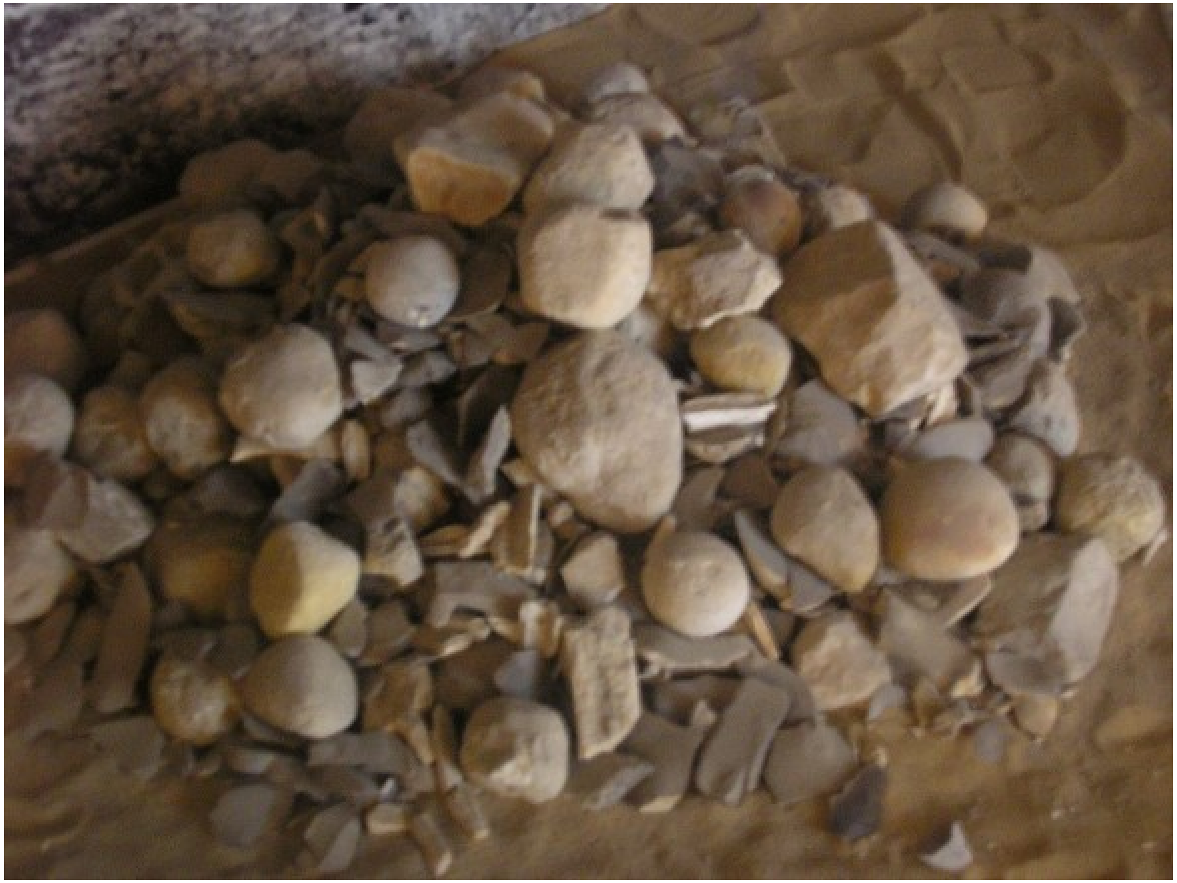
HIGHLIGHTS

- a lumped rainfall-runoff model was optimised to simulate daily discharge of a group of springs from Northern Italy
- future climate forecasts will induce a change of seasonal discharges, which will be more marked in summer and autumn seasons
- low flows will be affected while years with long periods of consecutive days with low flow are expected to be more frequent

GRAPHICAL ABSTRACT

Weather station (2013-2016)
Observed daily spring discharge (2013-2016)
calibration-validation
Modified HYMOD model
RCMs datasets
BASELINE (1984-2013)
FUTURE (2021-2050)
Baseline discharge
Future discharge
Low flow indices
Flow duration curve
Length of low flow
Check for updates
ELSEVIER
Science of the Total Environment

Hermaïon di El Guettar



Periodo Musteriano, Paleolitico medio.

Alcune caratteristiche ecologiche peculiari delle sorgenti

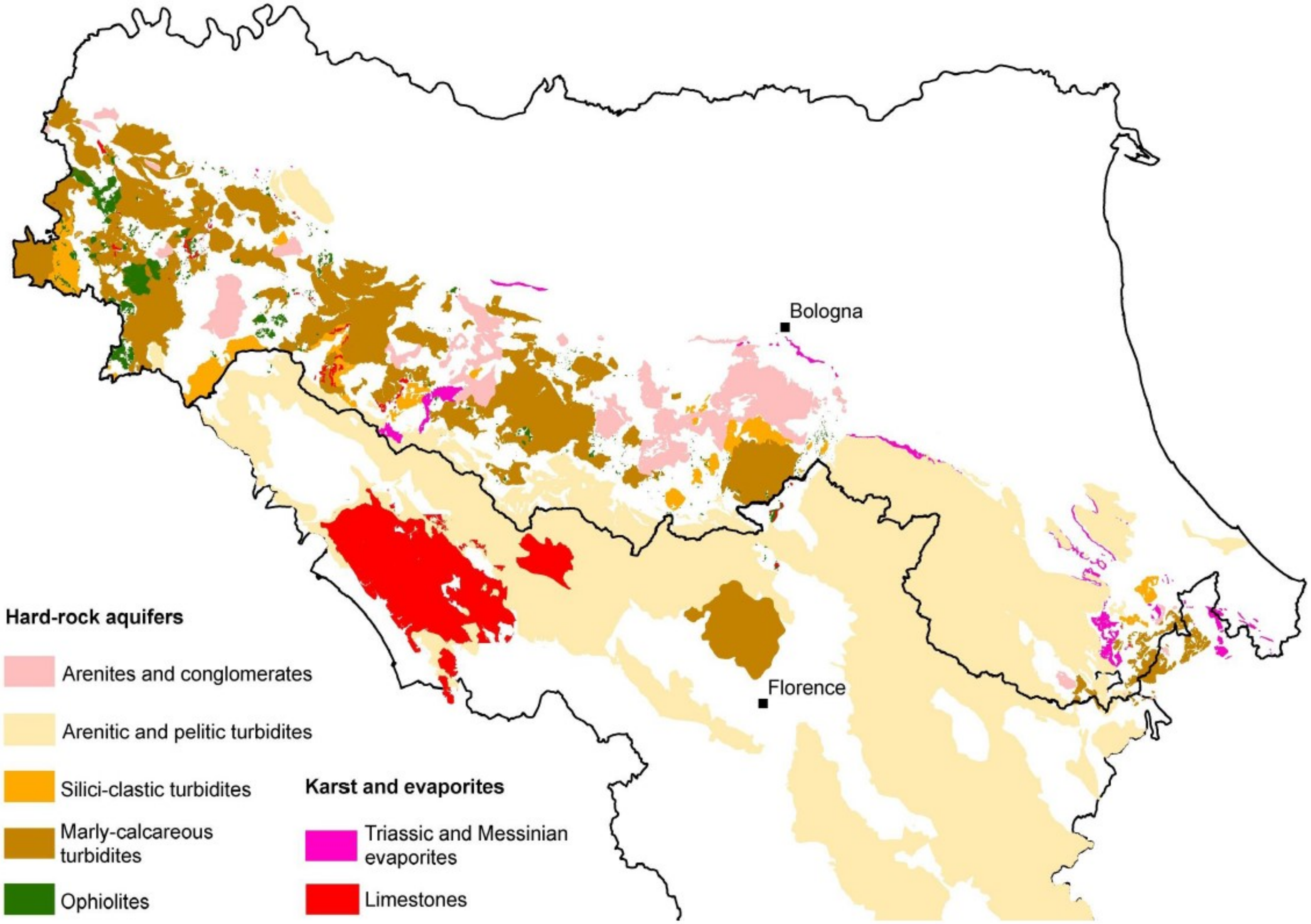
- I punti di emersione naturali delle acque sotterranee sono **ecotoni** tra acque freatiche, acque superficiali e habitat terrestri.

- Sono caratterizzate da una struttura a **mosaico**, si ha cioè coesistenza di diversi **microhabitat** (ad esempio accumulo di detrito vegetale, muschi, fogliame, substrati rocciosi, ecc.), ma anche la presenza di zone a diversa pendenza e velocità di scorrimento dell’acqua.

- Le sorgenti perenni presentano una generale **stabilità**.

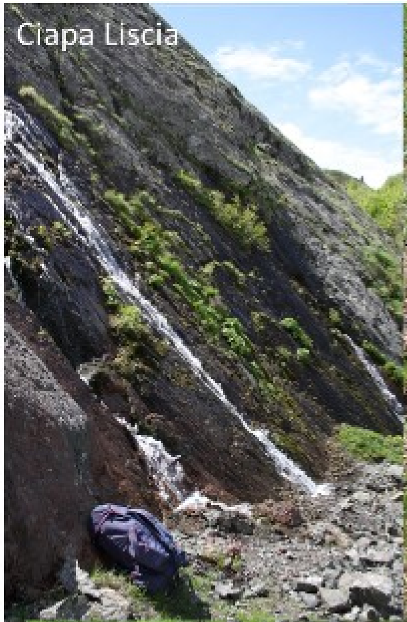
- Sono **biotopi insulari**.

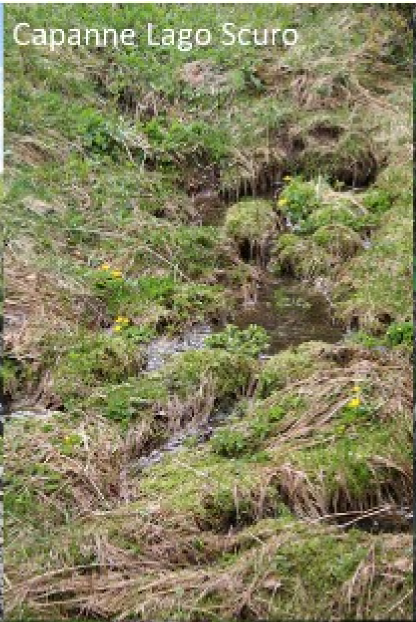
Gli acquiferi dell’Appennino settentrionale

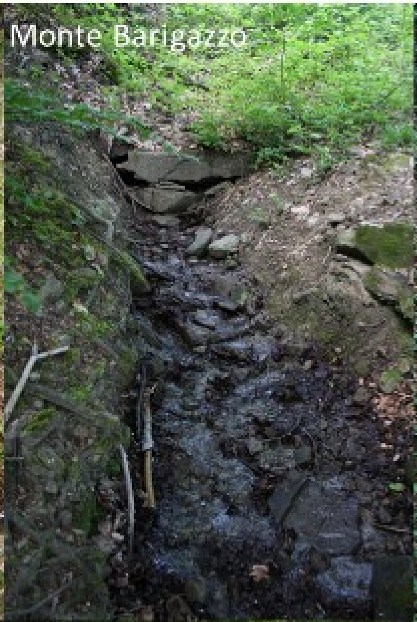

Bologna
Florence
Hard-rock aquifers
Arenites and conglomerates
Arenitic and pelitic turbidites
Silici-clastic turbidites
Marly-calcareous turbidites
Ophiolites
Karst and evaporites
Triassic and Messinian evaporites
Limestones

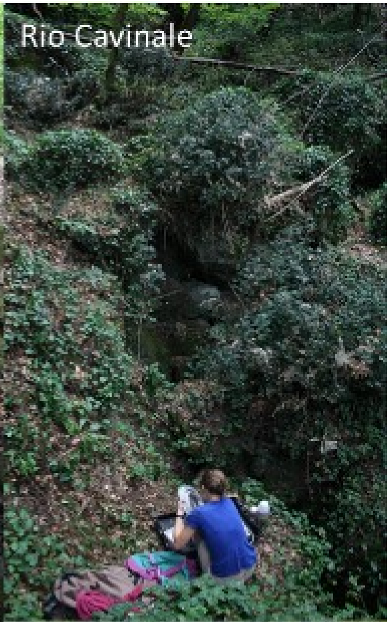
Cantonati *et al.*, 2014
https://www.researchgate.net/publication/264703840_Springs_as_main_groundwater_dependent_ecosystems

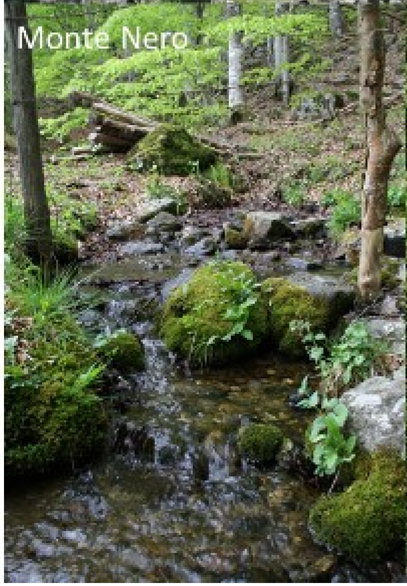
Come sono le sorgenti appenniniche?

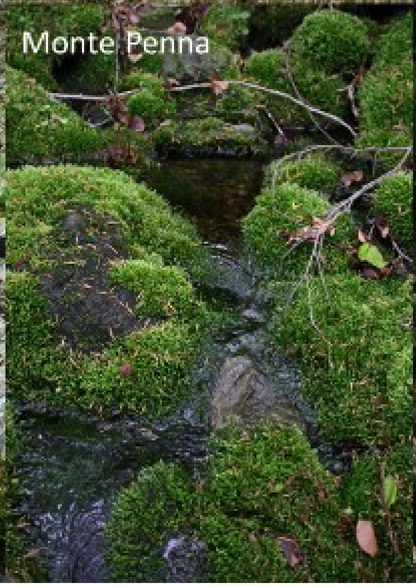

Ciapa Liscia

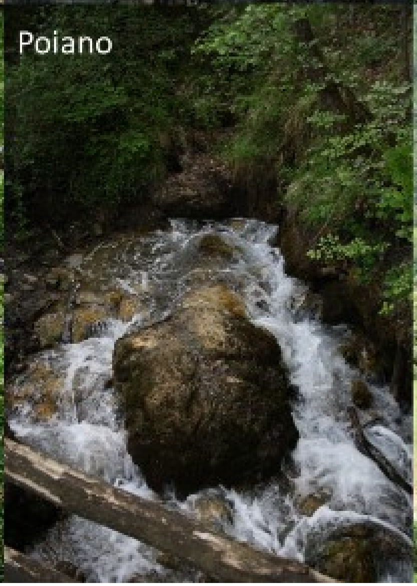

Capanne Lago Scuro

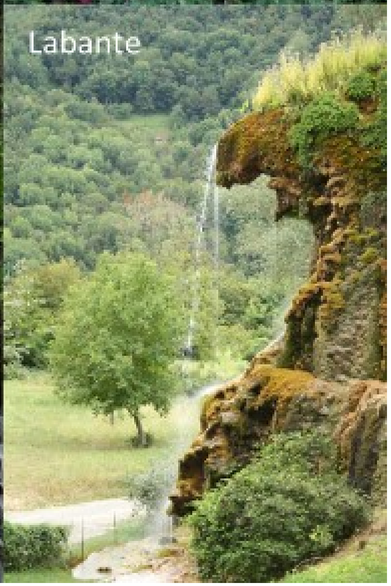

Monte Barigazzo


Rio Cavinale


Monte Nero


Monte Penna

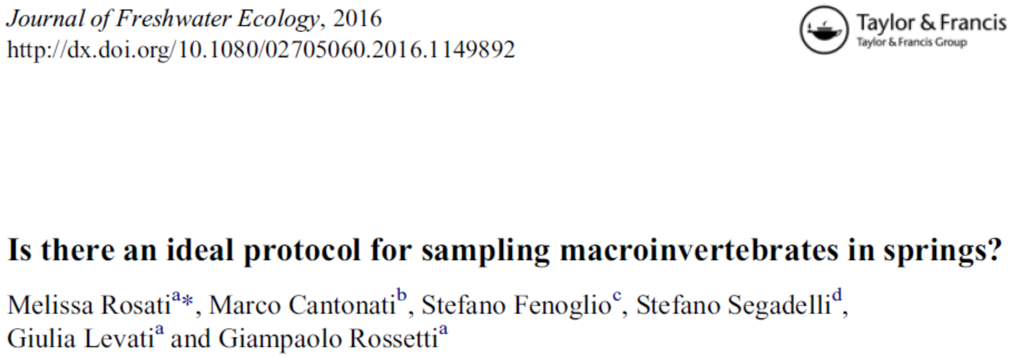

Poiano


Labante

Sorgenti montane e ostracodi: linee di ricerca

- Caratterizzazione delle sorgenti da un punto di vista ambientale, facendo riferimento ai principali paramenti idrologici ed idrochimici.
- Analisi delle comunità di ostracodi mediante un approccio multi-scala (locale, regionale e continentale).
- Studio dei fattori ecologici, locali e regionali, che condizionano la formazione delle comunità di sorgente (*assembly rules*, *niche filtering*).
- Confronto dell'efficacia di diversi metodi di campionamento e messa a punto di tecniche di prelievo non invasive (trappole e lavaggio della vegetazione).
- Valutazione dei principali impatti antropici sulle sorgenti come supporto scientifico per la loro conservazione e gestione.

Sorgenti montane e ostracodi: alcuni articoli

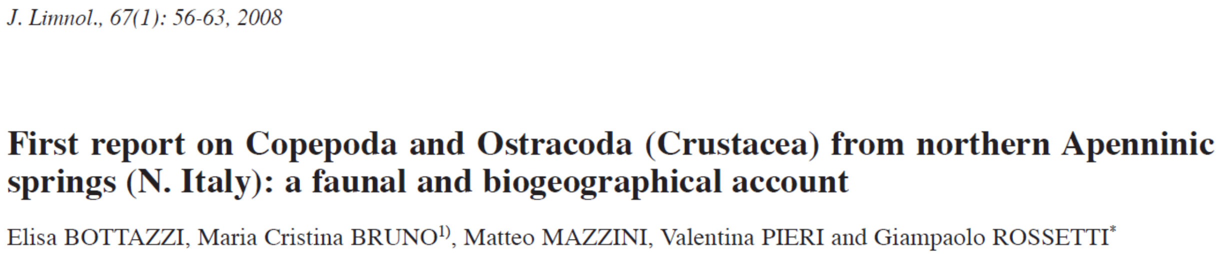


Journal of Freshwater Ecology, 2016
http://dx.doi.org/10.1080/02705060.2016.1149892

Taylor & Francis
Taylor & Francis Group

Is there an ideal protocol for sampling macroinvertebrates in springs?

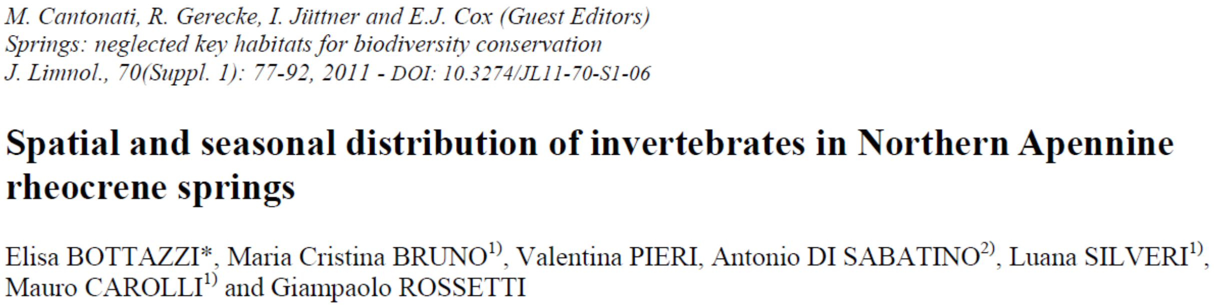
Melissa Rosati[a]*, Marco Cantonati[b], Stefano Fenoglio[c], Stefano Segadelli[d],
Giulia Levati[a] and Giampaolo Rossetti[a]



J. Limnol., 67(1): 56-63, 2008

First report on Copepoda and Ostracoda (Crustacea) from northern Apenninic springs (N. Italy): a faunal and biogeographical account

Elisa BOTTAZZI, Maria Cristina BRUNO1), Matteo MAZZINI, Valentina PIERI and Giampaolo ROSSETTI*

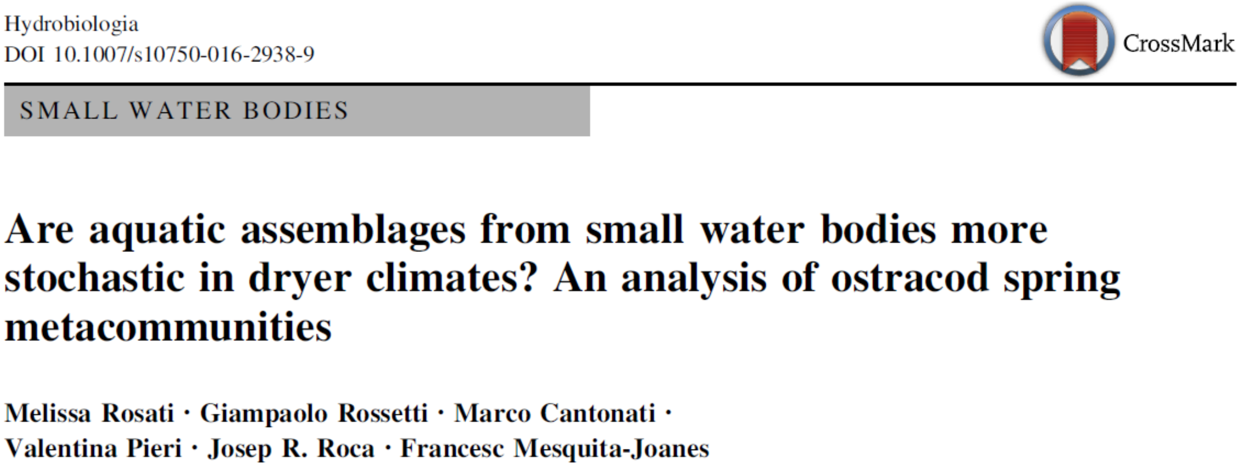


M. Cantonati, R. Gerecke, I. Jüttner and E.J. Cox (Guest Editors)
Springs: neglected key habitats for biodiversity conservation
J. Limnol., 70(Suppl. 1): 77-92, 2011 - DOI: 10.3274/JL11-70-S1-06

Spatial and seasonal distribution of invertebrates in Northern Apennine rheocrene springs

Elisa BOTTAZZI*, Maria Cristina BRUNO1), Valentina PIERI, Antonio DI SABATINO2), Luana SILVERI1),
Mauro CAROLLI1) and Giampaolo ROSSETTI

Sorgenti montane e ostracodi: alcuni articoli

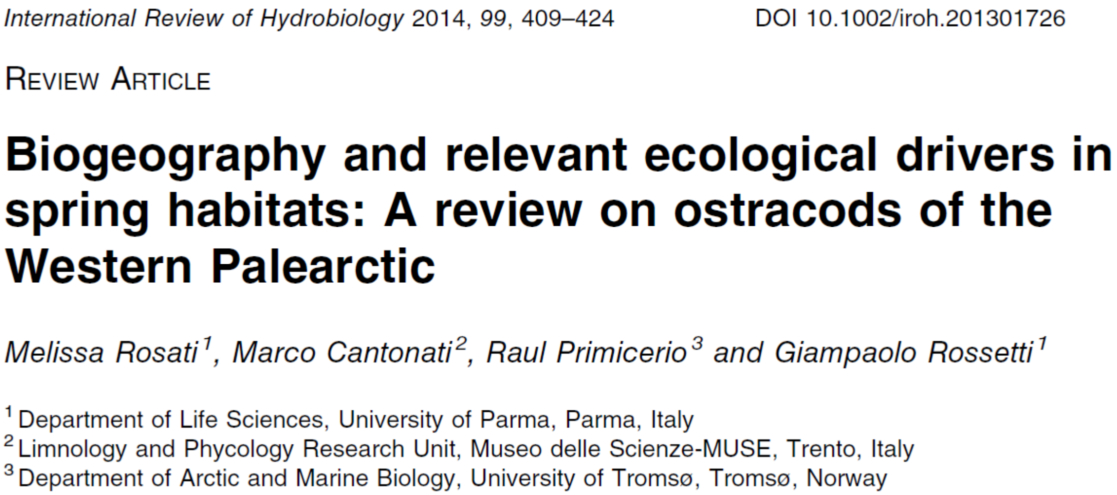


Hydrobiologia
DOI 10.1007/s10750-016-2938-9

SMALL WATER BODIES

Are aquatic assemblages from small water bodies more stochastic in dryer climates? An analysis of ostracod spring metacommunities

**Melissa Rosati · Giampaolo Rossetti · Marco Cantonati ·
Valentina Pieri · Josep R. Roca · Francesc Mesquita-Joanes**



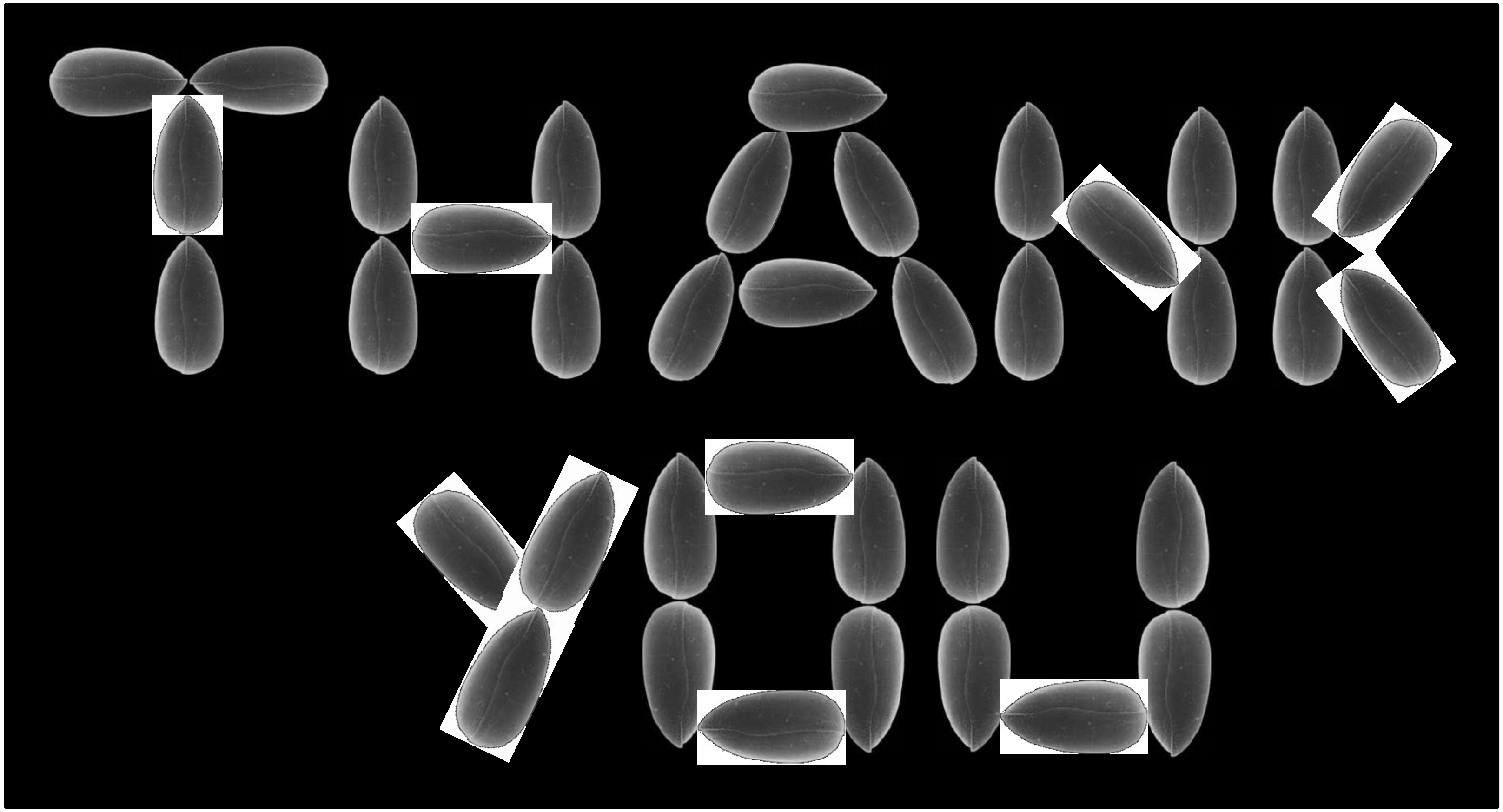
International Review of Hydrobiology 2014, 99, 409–424 DOI 10.1002/iroh.201301726

REVIEW ARTICLE

Biogeography and relevant ecological drivers in spring habitats: A review on ostracods of the Western Palearctic

Melissa Rosati[1], Marco Cantonati[2], Raul Primicerio[3] and Giampaolo Rossetti[1]

[1] Department of Life Sciences, University of Parma, Parma, Italy
[2] Limnology and Phycology Research Unit, Museo delle Scienze-MUSE, Trento, Italy
[3] Department of Arctic and Marine Biology, University of Tromsø, Tromsø, Norway


THANK
YOU