



‘Meiofauna from chemosynthetic deep-sea environments’

Report on the ChEss workshop held
17 July 2010
At Ghent University, Belgium



Workshop participants:

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1. Overview and introduction

The aim of this workshop was to bring together meiofauna researchers who are interested in any biological aspect concerning deep-sea chemosynthetic environments, such as hydrothermal vents, cold seeps, whale falls, sunken wood, and areas of low oxygen that intersect with continental margins and seamounts.

The participants initiated a platform, called **RoMeio** (Reducing enviroNments & Meiofauna) aiming to exchange knowledge on these topics to enhance our understanding of the fascinating reducing ecosystems. We had sessions in which we discussed the current state of knowledge of biogeography, biodiversity and abundance, ecology, origin and evolution, morphological and molecular phylogeny, and taxonomy, and future plans. Further, we discussed the possibilities of multidisciplinary and integrative research, building a platform of researchers to combine our efforts in databases, field programs, and outreach activities.

Meiofauna research at reducing environments such as deep-sea hydrothermal vents and cold seeps is a young research field. Most detailed studies have been ongoing only since ~7 years. The majority of scientists that had published in this research area were present at this workshop. In addition, some scientists with plans to work on meiofauna from reducing environments were also present. Workshop participants came from 13 countries (Austria, Belgium, Brazil, Chile, England, Germany, Greece, Portugal, Netherlands, Russia, Taiwan, USA, and Vietnam). About one third of participants were professors, another third post-docs, and another third graduate students (see point 10. workshop participants). In order to get an overview on our current knowledge, current studies, and future plans, the participants were contributing with filling out a questionnaire prior the workshop.

At the workshop, the introduction session lead by S. Gollner was used to give a short overview on environmental conditions and macrofauna knowledge from deep-sea hydrothermal vents, cold seeps, whale falls, wood falls, and oxygen minimum zones. Afterwards, single sessions were started by a summary of the current state of meiofauna knowledge provided by A. Vanreusel (AV) and S. Gollner (SG), followed by discussions on several topics.

2. Agenda

9.00 – 9.45 Introduction and Meeting Overview (chair SG)
9.45 – 10.15 one-minute personal introduction of participants (all)
10.15– 10.45 coffee break (provided by the organizers)
10.45 – 12.15 Session 1: Taxonomy (chair SG)

12.15 – 13.15 lunch (provided by the organizers)

13.15 – 14.30 Session 2: Biology of selected taxa (chair AV)
14.30 – 15.00 coffee break (provided by the organizers)
15.00 – 16.00 Session 3: Community Ecology (chair SG)
16.00 – 17.30 Session 4: homepage, integrative and multidisciplinary approaches, future questions, international collaboration, outreach

18.30 Dinner at the African Queen (provided by the organizers)

3. Taxonomy

3.1. Current stage of knowledge

3.1.1. Estimate of described species

The number of taxonomically described species is quite limited: at vents, 10 nematode species, 84 copepods, 1 gastrotrich, 9 ostracods, and two halacarids are known and an overview is given in the 2nd Edition of Handbook of Deep-Sea Hydrothermal Vent Fauna (Desbruyeres et al. 2006¹). The majority of species described from vents are from the Eastern Pacific. At seeps, 30 nematode (mostly from shallow seeps) and a few copepod species are described. To our knowledge, no species from whale or wood falls are described. One copepod species was found at hydrothermal vents, cold seeps, and wood falls (Christoph Plum pers. com.).

Overall, our knowledge on meiofauna species and their biogeographic distribution and habitat occurrence is quite poor. The prominent copepod family Dirivultidae is restricted to hydrothermal vents and the surrounding basalt (Gollner et al. 2010b). One copepod species was found at hydrothermal vents, cold seeps, and wood falls (Plum pers. com.). The probability that species found at chemosynthesis-based deep-sea habitats are already described from other habitats is estimated to be quite high, as detailed community studies with identification on species level have shown.

3.1.2. Estimate of molecular analyzed species

Several molecular studies are currently carried out, but so far no studies have been published, except for the study of several genes (COI, 18S, D2D3) from one seep nematode (Van Gaever et al. 2009) and one copepod (Huys et al. 2007). For vents, investigations on copepods (DZMB Senckenberg Institute) and for seeps, studies on nematodes (University of Ghent) are on their way. Notable, no studies on whale and wood falls, and OMZs are currently carried out.

3.2. Summary of output, recommendations, and plans

The participants agreed to build a webpage for all matters concerning the RoMeio community. Jyotsna Sharma will ask if the RoMeio community gets space on the International Association of Meiobenthologists (IAM) homepage.

3.2.1. List of currently described species (Table 1)

Described species will be listed on the “RoMeio page” and ‘working’ species (species that have been identified as new but not formally described) should be linked to “scratchpads.eu” (www.scratchpads.eu) from the Natural History Museum of London (NHML). Tim Ferrero and Natalie Barnes will study the “scratchpads.eu” intensively in order to decide if this platform is a good tool. Another possibility to show working species is the platform nemys (<http://nemys.ugent.be/>). The first structure within scratchpads will be made by Natalie Barnes.

¹Free download: <http://www.biologiezentrum.at/> click on “Publikationen” – “Densia”- “Volume 18” (note: pdf’s can be only downloaded when the German language is used)

A first list of currently described species from chemosynthetic environments will be provided by several participants. It has been agreed that the following information should be added if possible: substrate, geography, environmental conditions (temperature, oxygen, sulfide, pH concentrations), habitat description, depth of sediment. Working species should include as much information as possible for identification (light micrographs, drawings, comments). This detailed list will be available on the RoMeio webpage, a first species list is provided in Table 1.

3.2.2. List of molecular analyzed species

As currently, no sequences of meiofauna species, except one nematode and one copepod, are published, no such list can be made right now. In future, such a list of sequenced species and type of sequence will be provided.

3.2.3. List of ongoing sequencing projects (Table 2)

A list of ongoing projects will be provided by several participants..

3.2.4. List of sequencing protocols (Table 3)

These protocols will be provided by several participants (Jelle van Campenhout, Annelies de Grootte, Natalie Barnes, Nikos Lampadariou, Sabine Gollner).

3.2.5. List of taxonomists (Table 4)

The participants agreed on building a network of taxonomists, who are interested in identifying and/or describing species from chemosynthetic environments. Upon agreement of taxonomists, a comprehensive list will be available on the webpage.

3.2.6. Recommendations

Whenever species are sent to taxonomists for formal description, information on the abundance of this species, biogeographic occurrence and ecosystem/habitat information should be included. In order to prevent double descriptions, information on currently executed species descriptions should be made available online.

The priority of species descriptions should be according to abundance, broadness of habitats, and possibly species with symbionts.

It was further suggested that paratypes should be available in one museum, to make it easier in future to compare species. It has been decided by the participants, to send paratypes of copepods to the Senckenberg Museum (Wilhelmshaven, Germany) and nematodes to the Natural History Museum (London, U.K.).

One type of fixation for all different meiofauna taxa has been recognized as a serious problem in meiofauna research for a long time. While, for example fixation in 4% buffered formaldehyde was found best for nematodes, it gives poor results for foraminiferans and ostracods. Therefore it, was recommend to fix samples in several ways, whenever possible (i.e. 4% buffered formaldehyde, 70% EtOH, glutaraldehyde). Information on fixation techniques are provided in Higgins & Thiel (1988).

Scientists are encouraged to use molecular methods, since this is one important way to understand the connectivity between different chemosynthetic ecosystems and biogeographic distribution and patterns.

For molecular studies, it is recommended to use 99.9% ETOH for copepods, and freezing or DESS (solution containing 20% dimethyl sulphoxide DMSO and 0.25 M disodium EDTA, saturated with NaCl, pH 8.0; Seutin et al. 1991) for nematodes. This is based on the experience of some of the participants, who found that sequencing of ETOH fixed nematode material did not work well and DESS gave about 85% of positive results. Also, morphological identification after freezing was found quite difficult, although sequencing was successful. The participants agreed on the usage of several molecular markers, however the specific types have not been discussed in detail. As for usage of specific primers, Folmer primers of COI (Folmer et al. 1994) did rarely work on nematodes but were successful when using dirivultid copepods (Sabine Gollner pers. comm.).

3.2.7. Plan for molecular training workshop

Prior the meeting, several participants stated their need for molecular training. Such a training workshop could take place prior the next meiofauna conference in Seoul (Korea) in 2013. Ann Vanreusel will contact the organizers of this conference.

4. Biology of selected taxa

Our current stage of knowledge on the biology of meiofauna in general and selected taxa from chemosynthetic environments is highly limited. Several aspects emerged through discussions, which the participants plan to follow up in future.

4.1. Biomass - production

In general, nematodes are often but not always larger (higher biomass) in chemosynthetic environments than in other habitats. *Oncholaimus* specimens at the Mid Atlantic Ridge can reach up to several cm. Possible reasons for this evolutionary shift from small to large species (little to high biomass) are not known, but several the factors such as O₂ and/or H₂S stress, and higher food availability due to primary production appear reasonable and need to be tested in future.

As in other ecosystems, the occurrence of meiofauna and specific taxa in terms of number of individuals is highly patchy. The underlying causes such as productivity, disturbance, and/or stress are not investigated yet.

4.2. Feeding behavior and trophic structure

Most commonly employed are stable isotope and fatty acid (FA) analyses. However such studies including meiofauna from chemosynthetic ecosystems are still scarce (Van Gaever et al. 2009). The food web at the Håkon Mosby mud volcano increased in complexity with increasing distance from the centre of the mud volcano (Van Gaever et al. 2009). Also, studies on specific analyses of gut content are rare. A single study revealed that vent copepod species had a varied diet (Limén et al. 2008).

Associations between chemoautotrophic (thiotrophic or methanotrophic) or heterotrophic bacteria and large-sized animals are well known at deep-sea chemosynthetic ecosystems, but only a few of such symbioses have so far been discovered in smaller size class (Bernhard et al., 2000, Katz et al. 2006, Kouris et al. 2007). Most of the large animal symbioses proved to be nutritional associations in which the host relies at least partly on its symbionts, while a nutritional link of symbioses between microbes and nematodes (Bernhard et al. 2000), solenogastres (Katz et al. 2006), folliculid ciliates (Kouris et al. 2007), or loriciferans (Danovaro et al. 2010) was not studied yet. Typical symbiotic nematodes found in other than deep-sea chemosynthetic ecosystems (Ott et al. 2004), but so far not at deep-sea seeps, vents, wood or whale falls, have been found at shallow-water seeps (*Astomonema*) and in regular deep-sea sediments (*Parastomonema* and *Stilbonematinae*) (Dando et al. 1991, Austen et al. 1993). Only in the oxygen minimum zone of the Santa Barbara basin, a nematode with epicuticular bacteria (*Desmodora masira*) was found (Bernhard et al. 2000). Next to electron microscopical techniques, in situ hybridization techniques for detecting microbial symbionts are recommended.

4.3. Biological Interactions

A negative correlation between seep meio- and macrofauna abundances in soft sediments was found (e.g. Van Gaever et al. 2009). This negative trend is also seen at whale falls (Debenham et al. 2004). At vents, where low abundances often occur, it has been speculated that the highly abundant macrofauna outcompetes and/or feeds on the smaller meiofauna, thus controlling the abundance (Gollner et al. 2010).

4.4. Reproduction

In general, little is known on reproduction strategies. *Halomonhystera disjuncta* (Håkon Mosby mud volcano) has an ovoviviparous reproductive strategy, which has not been observed for other seep nematodes (Van Gaever et al. 2006).

4.4. Stress tolerance

Several sources creating potentially stressful conditions are present at chemosynthetic habitats, among others most importantly low oxygen concentrations and presence of hydrogen sulfide. At vents additionally, temperatures higher than deep-sea ambient, low pH, presence of heavy metals, and most importantly fluctuations of all parameters are found. Except for findings of sulfur granules as indication of sulfide detoxification in the nematodes *Sabatieria* and *Oncholaimus* (Thiermann et al. 1994), and LD₅₀ studies on hypoxic and anoxic conditions in an antarctic monacelid plathelminth from shallow-water vents (Bright et al. 2003), no detailed physiological studies have been conducted to our knowledge. Meiofauna would be especially suitable to stress tolerance studies, because it is small and escape mechanisms from unfavorable conditions more difficult than for large macro- and megafauna.

Most recently, loriciferans have been found in anoxic sediment beneath brine. They lack mitochondria, but have hydrogenosome-like organelles and endosymbiotic prokaryotes (Danovaro et al. 2010) similar to anaerobic ciliates. If these first results prove true, this would be the first animal with exclusively anaerobic metabolism.

4.5. Dispersal

There is virtually nothing known on the dispersal of meiofauna from chemosynthetic deep-sea ecosystems. Several ways seem conceivable but need to be tested in future: through marine snow, macroalgae (? The nematode *Halomonhystera disjuncta* was found on macroalgae), hitch-hiking on macrofauna, and/or enormous stochastic events. Some resting stages (cysts) may also play a role. Very interesting future aspects are to study the dispersal within ecosystems as well as the possible connection of vent and seep meiofauna species.

5. Community ecology

5.1. Current state of knowledge

5.1.1. Diversity and origin at deep-sea hydrothermal vents

Meiofauna currently contributes to about 20 % of the total diversity known from deep-sea hydrothermal vents (Bright 2006). Almost all studies have been conducted along the East Pacific Rise. All other regions are not studied, with the exception of one community study from the Mid Atlantic Ridge (Zekely et al. 2006), one nematode study from sedimented vents in the North Fiji Basin (Vanreusel et al. 1997), and another nematode study from Iheya Ridge (Shirayama 1992). Nematodes were also studied in mussel beds from EPR (Flint et al. 2006, Zekely et al. 2006, Copley et al. 2007). Copepod data are available from sulfide chimneys at the Juan de Fuca Ridge (Tsurumi et al. 2003), and from mussel and tubeworm aggregations from East Pacific Rise (Gollner et al. 2006). Thus far, the entire meiofaunal communities were studied on species level only at the 9° and 11° North East Pacific Rise (Zekely et al. 2006, Gollner et al. 2007, Gollner et al. 2010a) and at the 23° North Mid Atlantic Ridge (Zekely et al. 2006)(Table 5, Figure 1). In general, meiofauna diversity is low at deep-sea hydrothermal vents. At the 9°N East Pacific Rise an inverse correlation of meiofauna diversity with hydrothermal fluid emissions was observed and it was suggested that with increasing temperature and toxic hydrogen sulfide concentrations and increasing amplitude of variation of these factors, fewer species are able to cope with these extreme conditions. Thus, this results in less diverse communities in more extreme habitats (Gollner et al. 2010a).

The origin of vent meiofauna is still a puzzle. First observations indicate that meiofauna is not restricted to vents but is also present in the basalt hosted axial summit trough (Gollner et al. 2010). Interestingly, nematodes seem to be subset of the surrounding deep-sea plain fauna, suggesting local adaptation (Vanreusel et al. 2010). In contrast, many harpacticoid copepod genera found at vents, are also present in shallow-water environments (Gollner et al. 2010a). Members of the family of dirivultid copepods are only known from deep-sea hydrothermal vents and from the axial summit trough (Gollner et al. 2010b).

5.1.2. Diversity and origin at deep-sea cold seeps

The large majority of deep-sea cold seep studies was performed in the Atlantic, and most of them are on higher taxa level (for details see Table 5, Figure 1). Nematodes were studied in detail at the Håkon Musby mud volcano, at Nyegga/Storegga, and in the Gulf of Guinea (Van Gaever et al. 2006, Van Gaever et al. 2009a, b). Not a single study describes the whole meiofaunal community. Nematode genera richness seems inversely correlated to seep fluid emissions (Vanreusel et al. 2010).

The origin of seep-meiofauna is unclear yet. Nematodes seem to have shallow-water, rather than typical deep-sea relatives (Vanreusel et al. 2010). There are no detailed copepod studies, but some described species have relatives also in the shallow water (i.e. the species *Smacigastes metanophilus*, Plum & Matrínez Arbizu 2009). Dirivultid copepods, that are very prominent at vents, are not known from seeps (Gollner et al. 2010b).

5.1.3. Diversity in other reducing environments

Only one study on higher taxon level is published from deep-sea whale falls (Debenham et al. 2004). Also, only one shallow whale-fall nematode community was analyzed in detail

(Pavlyuk et al. 2009). Wood-fall studies are lacking. Most studies from shallow seeps and vents are on higher taxon level. A few shallow vent and seep studies concentrated on nematodes. In general, meiofauna at shallow vents, seeps, and whale falls seems to be a subset of the surrounding fauna (Table 5, Figure 1).

5.1.4. Map of community studies (Table 5, Figure 1)

5.2. Current projects

Many projects are currently on the way and a list of ongoing projects will be available at the RoMeio webpage. Deep-sea vent studies are carried out in the Eastern (9 North East Pacific Rise) and Western Pacific (Lau Basin), and at the Mid Atlantic Ridge. Seeps are studied in the Atlantic (Gulf of Cadiz, Håkon Musby, Gulf of Mexico) and in the Mediterranean Sea. OMZ are also studied in the Mediterranean Sea, the Black Sea, and in the Pacific off Chile. The higher taxon whale fall study from Debenham et al. (2004) is currently expanded and now nematodes are studied in detail. Shallow vent studies are ongoing in Taiwan at Turtle Island.

5.3. Summary of output, recommendations, plans

5.3.1. List of samples available/searched for

Due to the fact that often only one higher taxon is identified to species level, and other taxa are just counted, it is highly recommended to offer these samples to other researchers. This way, all data on the entire community can be combined. In future it is recommended to include financial support for taxonomists also in proposals. A list of research interests/samples searched for/samples available will be provided and updated regularly on the webpage.

5.3.2. Sampling

Intrinsic to quantitative sampling is the difficulties in using different sampling devices according to the substrate, infauna in sediment versus epifauna on hard substrate, epifauna among large megafaunal foundation species. Cores for sediments samples, mussel pot, Bushmaster, or grabs for hard substrate and foundation species are difficult to compare. Therefore the interpretation of data needs to be carefully and cautiously done.

It is recommended to take pictures of samples in situ. Means of measuring/estimating the complexity of samples need to be developed and scaled including different variables

5.3.3. Sample size and subsampling

It is recommended to use small sampling sizes but increase the number of samples. Also subsampling of larger samples by splitting the samples is recommended.

5.3.4. Sieve sizes

The lower and upper limit defining meiofauna has been discussed in detail. For reasons of standardization within the community we suggest the usage the 32 μm sieve. It is known that especially with the usage of a 63 μm a relatively high percentage of the community is lost (especially nematodes). However, this effect is expected to be minor in the reducing environments where often meiofauna is relatively large (in deep-sea plains the effect is thought to be very large). Further, we suggest that no upper size limit is made for the typical

permanent meiofaunal taxa (i.e. nematodes, copepods, ostracods,..), since it is known that some can become > 1mm.

6. Integrative & multidisciplinary approaches

The efforts for combining meiofauna expertise as well as extending collaborations with other disciplines was discussed in length. On the biological level, knowledge on the macro-, megafauna as well as the microbial community level are needed to understand the meiofauna community. Further, the characterization of the physico-chemical environment is of utmost importance. While measurements and estimations of all biotic and abiotic factors from a single sample are recommended it should be noted that this is not always possible.

On a large scale, there are several large biogeographic areas, such as vent studies in the Atlantic and the Indian Ocean, seep studies in the Pacific ocean, more studies on whale falls and wood falls, which are virtually unknown, and these gaps should be closed. Also areas in which several types of ecosystems are close by like New Zealand would be of great interest to study. Further, areas with shallow and deep sites close by like Turtle Island and the Okinawa Trench would be likewise interesting.

The need for creating a platform and network among meiofauna researchers and outreach to other disciplines was strongly stated. Furthermore, the promotion of meiofauna research among meiofauna research and other disciplines in the field of deep-sea chemosynthetic environments to increase the awareness of our discipline has been identified of utmost importance. The RoMeio community and webpage is a first attempt to follow these goals.

In future, material that is available for other meiofauna researchers will be posted on the webpage. Also, scientists looking for samples can post their wishes.

The participants also agreed on providing raw data on the webpage once they have been officially published. Mandatory for the use of such data is the agreement of the authors.

7. Public Outreach

Public outreach has been done individually so far. It is recommended to continue with these national projects. Information will be provided on the webpage as well as a collection of nice pictures to promote the awareness of meiofauna research to the public.

8. Homepage summary

- Page integrated on IAM homepage

- Working species descriptions linked to 'scratchpad'

Who is responsible?

- IAM has an editor; who agreed to set up the RoMeio webpage

- Ellen Pape and Richard Lee will be responsible/help with layout

What information should be on the homepage?

- List of members

- List of taxonomists

- List of species

- DNA protocols

- Current/planned projects

- Interests of scientists/Material searched

- Public outreach experience

Who is providing information?

- Sabine Gollner will collect & summarize the first information for the homepage

- Future information will be sent by the scientists to Ellen Pape, Richard Lee, and the editor of IAM

9. References

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10. Participants

The following persons participated in the first workshop on meiofauna from chemosynthetic deep-sea environments and initiated the RoMeio (Reducing environments & Meiofauna) community – a group of researchers interested in meiofauna from reducing environments and aiming to exchange knowledge on these topics to enhance our understanding of the fascinating reducing ecosystems.

last name	first name	university	country	e - mail
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11. Organizing committee

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12. Workshop location

University Ghent
Biology Department
Krijgslaan 281
S8 sterrecampus
9000 Ghent
Belgium

Finances

Dinner and Tickets public transportation for all participants:	643.50 €
Gollner (organizer) hotel (2 nights):	163.50 €
Financial support for all workshop participants:	1193.00 €
Total:	2000.00 €

Table 1. Currently described meiofauna species from hydrothermal vents and cold seeps.

HV = hydrothermal vent, CS = cold seep, O = Ostracoda, C = Copepoda, G = Gastrotricha, N = Nematoda

Taxon	Species	environment	species description
O	<i>Archiconchoecia chavturi</i>	HV	Kornicker LS, Harrison-Nelson E (2005) Zootaxa 1071: 19-38.
O	<i>Bathyonchoecia deeveyae</i>	HV?	Kornicker LS (1969) Proc Biol Soc Wash 82: 403-408.
O	<i>Bathyonchoecia paulula</i>	HV? CS?	Deevey GB (1968) Proc Biol Soc Wash 81: 539-570.
O	<i>Euphilomedes climax</i>	HV	Kornicker LS (1991) Smithson Contr Zool 516: 1-46.
O	<i>Polycopetta pax</i>	HV	Kornicker LS, Harrison-Nelson E (2005) Zootaxa 1071: 19-38.
O	<i>Prionotoleberis styx</i>	HV	Kornicker LS (1991) Smithson Contr Zool 516: 1-46.
O	<i>Thomontocypris brightae</i>	HV	Maddocks RF (2006) Micropalaeontology 51: 345-372.
O	<i>Thomontocypris gollnerae</i>	HV	Maddocks RF (2006) Micropalaeontology 51: 345-372.
O	<i>Xylocythere vanharteni</i>	HV	Maddocks RF (2006) Micropalaeontology 51: 345-372.
C	<i>Ambilimbus arcuscelestis</i>	HV	Ivanenko VN et al. (2005) Marine Biology Research 1(3): 233-241
C	<i>Ambilimbus altalis</i>	HV	Humes AG, Huys R (1992) Can J Zool 70: 1369-1380.
C	<i>Ambilimbus tuerkayi</i>	HV	Martinez Arbizu (1999) J Crust Biol 19: 93-105.
C	<i>Andromastax cephaloceratus</i>	HV	Lee W & Huys R (2000) Zool J Linn Soc 129: 1-71.
C	<i>Andromastax muricatus</i>	HV	Conroy-Dalton S & Huys R (1999) J Crustac Biol 19(2): 408-431.
C	<i>Aphotopontius acanthinus</i>	HV	Humes AG, Lutz RA (1994) J Crustacean Biol 14(2): 337-345.
C	<i>Aphotopontius arcuatus</i>	HV	Humes AG (1987) B Mar Sci 41(3): 645-788.
C	<i>Aphotopontius atlanteus</i>	HV	Humes AG (1996) B Mar Sci 58(3): 609-653.
C	<i>Aphotopontius baculigerus</i>	HV	Humes AG (1987) B Mar Sci 41(3): 645-788.
C	<i>Aphotopontius flexispina</i>	HV	Humes AG (1987) B Mar Sci 41(3): 645-788.
C	<i>Aphotopontius forcipatus</i>	HV	Humes AG (1987) B Mar Sci 41(3): 645-788.
C	<i>Aphotopontius hydronauticus</i>	HV	Humes AG (1989) Bull Mus natl Hist nat, Paris 11: 829-849.
C	<i>Aphotopontius limatulus</i>	HV	Humes AG (1987) B Mar Sci 41(3): 645-788.
C	<i>Aphotopontius mammillatus</i>	HV	Humes AG (1987) B Mar Sci 41(3): 645-788.
C	<i>Aphotopontius probolus</i>	HV	Humes AG (1990) Scient Mar 54(2): 145-154.
C	<i>Argestoides prehensilis</i>	HV	Huys R, Conroy-Dalton S (1997) Cah. Biol. Mar. 38: 235-249.
C	<i>Barathricola rimensis</i>	HV	Humes AG (1999) J. Nat. Hist. 33: 961-978
C	<i>Bathylaophonte azorica</i>	HV	Lee W, Huys R (1999): Cah Biol Mar (40): 293-328.
C	<i>Bathylaophonte pacifica</i>	HV	Lee W, Huys R (1999): Cah Biol Mar (40): 293-328.
C	<i>Benthoxynus spiculifer</i>	HV	Humes AG (1984) Can J Zool 62: 2594-2599.
C	<i>Benthoxynus tumidisetia</i>	HV	Humes AG (1989) Bull Mus natl Hist nat, Paris 11: 829-849.
C	<i>Ceuthoecetes acanthothrix</i>	HV	Humes AG (1987) B Mar Sci 41(3): 645-788.
C	<i>Ceuthoecetes aliger</i>	HV	Humes AG, Dojiri M (1980) Proc Biol Soc Was 93(3): 697-707.
C	<i>Ceuthoecetes cristatus</i>	HV	Humes AG (1987) B Mar Sci 41(3): 645-788.
C	<i>Ceuthoecetes introversus</i>	HV	Humes AG (1987) B Mar Sci 41(3): 645-788.
C	<i>Chasmatopontius thescalus</i>	HV	Humes AG (1990) J Nat Hist 24: 289-304.
C	<i>Cheramomyzon abyssale</i>	HV	Humes AG (1989) Bull Mus Natl Hist Nat, Paris, 4e sér. 11, section A (4): 829-849.
C	<i>Cholidya polypi</i>	HV, cosmopolitan?	Farran (1914)
C	<i>Collocherides brychius</i>	HV	Humes AG (1999) Proc Biol Soc Wash 112(1): 181-188.
C	<i>Delavalia gundulae</i>	HV, CS	Willen E (2003) J of Nat Hist 37 (14): 1691-1711.
C	<i>Dirivultus dentaneus</i>	HV?, CS?	Humes AG, Dojiri M (1980) Pac Sci 34(2): 143-151.
C	<i>Dirivultus spinigulatus</i>	HV	Humes AG (1999) J Mar Biol Assoc UK 79: 1053-1060.
C	<i>Ecbathyrion prolixicauda</i>	HV	Humes AG (1987) Bull Mar Sci 41: 645-788
C	<i>Erebonaster protentipes</i>	HV	Humes AG (1987) Bull Mar Sci 41: 645-788
C	<i>Erebonaster spinulosus</i>	CS	Humes AG (1989) Hydrobiologia 175(3): 175-182.
C	<i>Exrima dolichopus</i>	HV	Humes AG (1987) B Mar Sci 41(3): 645-788.
C	<i>Exrima singula</i>	HV	Humes AG (1987) B Mar Sci 41(3): 645-788.
C	<i>Fissuricola caritus</i>	HV	Humes AG (1987) B Mar Sci 41(3): 645-788.
C	<i>Genesis vulcanoptusi</i>	HV	López-González PJ, et al. (2000) Cah Biol Mar 41: 241-253.

C	<i>Grievella shanki</i>	HV, plankton	Ferrari FD, Markhaseva EL (2000) Proc Biol Soc Wash 113 (4): 1079-1088.
C	<i>Heptnerina confusa</i>	HV	Ivanenko VN & Defaye D (2004) Zoosystema 26(1): 49-64.
C	<i>Heptnerina confusa</i>	HV	Ivanenko VN & Defaye D (2004) Zoosystema 26 (1): 49-64.
C	<i>Humesipontius arthuri</i>	HV	Ivanenko IV, Ferrari FD (2002) Arthropoda Selecta 11(3): 177-185.
C	<i>Hyphalion captans</i>	HV	Humes AG (1987) Bull Mar Sci 41: 645-788.
C	<i>Hyalopontius boxshalli</i>	HV	Humes AG (1988) Proc Biol Soc Wash 101: 825-831.
C	<i>Isaacscicalanus paucisetus</i>	HV, plankton	Flemiger A (1983) Proc Biol Soc Wash 96 (4): 605-622.
C	<i>Jamstecia terazakii</i>	HV	Lee W & Huys R (2000) Zool J Linn Soc 129: 1-71.
C	<i>Laimatobius crinitus</i>	HV	Humes AG (1987) Bull Mar Sci (41): 645-788.
C	<i>Methanocalanus gabonicus</i>	CS (pockmark)	Ivanenko VN et al. (2007) Cah Biol Mar 48(1): 37-54.
C	<i>Misophriopsis longicaudata</i>	HV	Humes AG (1999) J Nat Hist (33): 961-978.
C	<i>Nilva torifera</i>	HV	Humes AG (1987) B Mar Sci 41(3): 645-788.
C	<i>Oncea praeclara</i>	HV, plankton	Humes AG (1988) J Plankton Res 10: 475-485.
C	<i>Rhogobius contractus</i>	HV	Humes AG (1987) B Mar Sci 41(3): 645-788.
C	<i>Rhogobius pressulus</i>	HV	Humes AG (1989) Pac Sci 43(1): 27-31.
C	<i>Rhogobius rapunculus</i>	HV	Humes AG, Segonzac M (1998) Cah Biol Mar 39: 51-62.
C	<i>Rimipontius mediospinifer</i>	HV	Humes AG (1996) B Mar Sci 58(3): 609-653.
C	<i>Scabrantenna yooi</i>	HV	Lee W & Huys R (2000) Zool J Linn Soc 129: 1-71.
C	<i>Scotoecetes introrsus</i>	HV	Humes AG (1987) B Mar Sci 41(3): 645-788.
C	<i>Smacigastes barti</i>	HV	Gollner S et al. 2008 Zootaxa 1866: 323-336.
C	<i>Smacigastes methanophilus</i>	CS	Plum C. & PM Arbizu 2009 Zootaxa 2096: 338-355.
C	<i>Smacigastes micheli</i>	HV	Ivanenko V, Defaye D (2004) Cah Biol Mar 45 : 255-268.
C	<i>Stenhelia gundulae</i>	HV	Willen E (2003) J of Nat Hist 37 (14): 1691-1711.
C	<i>Stygiopontius appositus</i>	HV	Humes AG (1989) Zool Scr 18: 103-113.
C	<i>Stygiopontius brevispina</i>	HV	Humes AG (1991) Bull Mus natn Hist nat, Paris 13(4): 121-134.
C	<i>Stygiopontius cinctiger</i>	HV	Humes AG (1987) B Mar Sci 41(3): 645-788.
C	<i>Stygiopontius cladarus</i>	HV	Humes AG (1996) B Mar Sci 58(3): 609-653.
C	<i>Stygiopontius flexus</i>	HV	Humes AG (1987) B Mar Sci 41(3): 645-788.
C	<i>Stygiopontius hispidulus</i>	HV	Humes AG (1987) B Mar Sci 41(3): 645-788.
C	<i>Stygiopontius latulus</i>	HV	Humes AG (1996) B Mar Sci 58(3): 609-653.
C	<i>Stygiopontius lauensis</i>	HV	Humes AG (1991) Bull Mus natn Hist nat, Paris 13(4): 121-134.
C	<i>Stygiopontius lomonosovi</i>	HV	Ivanenko VN, Martinez Arbizu P, Stecher J (2006) Zootaxa 1277: 1-21.
C	<i>Stygiopontius mirus</i>	HV	Humes AG (1996) B Mar Sci 58(3): 609-653.
C	<i>Stygiopontius mucroniferus</i>	HV	Humes AG (1987) B Mar Sci 41(3): 645-788.
C	<i>Stygiopontius paxillifer</i>	HV	Humes AG (1989) Zool Scr 18: 103-113.
C	<i>Stygiopontius pectinatus</i>	HV	Humes AG (1987) B Mar Sci 41(3): 645-788.
C	<i>Stygiopontius quadrospinosus</i>	HV	Humes AG (1987) B Mar Sci 41(3): 645-788.
C	<i>Stygiopontius regius</i>	HV	Humes AG (1996) B Mar Sci 58(3): 609-653.
C	<i>Stygiopontius rimivagus</i>	HV	Humes AG (1997) Cah Biol Mar 38: 63-77.
C	<i>Stygiopontius sentifer</i>	HV	Humes AG (1987) B Mar Sci 41(3): 645-788.
C	<i>Stygiopontius serratus</i>	HV	Humes AG (1996) B Mar Sci 58(3): 609-653.
C	<i>Stygiopontius stabilitus</i>	HV	Humes AG (1990) J Nat Hist 24: 289-304.
C	<i>Stygiopontius teres</i>	HV	Humes AG (1996) B Mar Sci 58(3): 609-653.
C	<i>Stygiopontius verruculatus</i>	HV	Humes AG (1987) B Mar Sci 41(3): 645-788.
C	<i>Tychidion guyanese</i>	HV, CS	Humes AG (1973) Zoologische Mededelingen 46 (14): 189-196.
C	<i>Uptionyx verena</i>	HV	Conroy-Dalton S & Huys R (2000) Cah. Biol. Mar. 41(4): 343-397
C	<i>Xylora bathyalis</i>	HV, CS, wood fall	Hicks (1988)
C	<i>Xylora calyptogenae</i>	HV	Willen E (2006) Helgoland Marine Research 60(4): 257-272
G	<i>Desmodasys abyssalis</i>	HV	Kieneke A, Zekely J (2007) JMBA 2-Biodiversity records: 1-8.
N	<i>Acantholaimus quadridentatus</i>	CS	Jensen P (1985) Zool Scr 14: 247-263.
N	<i>Acanthopharyngoides bidentatus</i>	CS	Jensen P (1985) Zool Scr 14: 247-263.
N	<i>Aponema ninae</i>	CS	Portnova (2009) Zootaxa 2096: 197-213.
N	<i>Astomonema southwardorum</i>	CS	Austen MC, Warwick RM, Ryan KP (1993) JMBA UK 73: 627-634.

N	<i>Austranema mexicanum</i>	CS	Jensen P (1985) Zool Scr 14: 247-263.
N	<i>Calyptronema pulchrum</i>	CS	Jensen P (1986) Zool Scr 15 (2): 93-99.
N	<i>Cephalochaetosoma pacificum notium</i>	HV	Decraemer W, Gourbault N (1997): Zool Scr 26:1 -12.
N	<i>Chromaspirinia longisetosa</i>	CS	Jensen P (1985) Zool Scr 14: 247-263.
N	<i>Desmodora (Croconema) punctata</i>	CS	Jensen P (1985) Zool Scr 14: 247-263.
N	<i>Desmodora (Desmodora) curvispiculum</i>	CS	Jensen P (1985) Zool Scr 14: 247-263.
N	<i>Desmodora (Pseudochromadora) bulbosa</i>	CS	Jensen P (1985) Zool Scr 14: 247-263.
N	<i>Desmodora alberti</i>	HV	Verschelde D, Gourbault N, Vincx M (1998): J Mar Biol Ass UK 78:75-112.
N	<i>Desmodora marci</i>	HV	Verschelde D, Gourbault N, Vincx M (1998): J Mar Biol Ass UK 78:75-112.
N	<i>Desmodorella balteata</i>	HV	Verschelde D, Gourbault N, Vincx M (1998): J Mar Biol Ass UK 78:75-112.
N	<i>Desmodorella spineacaudata</i>	HV	Verschelde D, Gourbault N, Vincx M (1998): J Mar Biol Ass UK 78:75-112.
N	<i>Desmolaimoides thiohioticus</i>	CS	Jensen P (1986) Zool Scr 15 (1): 1-11.
N	<i>Dinetia nycterobia</i>	HV	Decraemer W, Gourbault N (1997): Zool Scr 26:1 -12.
N	<i>Enoploides polysetosus</i>	CS	Jensen P (1986) Zool Scr 15 (2): 93-99.
N	<i>Filitonchoides thiohioticus</i>	CS	Jensen P (1985) Zool Scr 14: 247-263.
N	<i>Gonionchus intermedius</i>	CS	Jensen P (1986) Zool Scr 15 (1): 1-11.
N	<i>Halomonhystera hickeyi</i>	HV	Zekely J, Sorensen M, Bright M (2006): Meiofauna Marina 15: 25-42.
N	<i>Ixonema powelli</i>	CS	Jensen P (1985) Zool Scr 14: 247-263.
N	<i>Leptosomatium woodsi</i>	CS	Jensen P (1986) Zool Scr 15 (2): 93-99.
N	<i>Linhomoeus giftingsi</i>	CS	Jensen P (1986) Zool Scr 15 (1): 1-11.
N	<i>Marylynnia johanseni</i>	CS	Jensen P (1985) Zool Scr 14: 247-263.
N	<i>Marylynnia punctata</i>	CS	Jensen P (1985) Zool Scr 14: 247-263.
N	<i>Moravecnema segonzaci</i>	HV	Justine JL, Petter A (2002): Folia Parasitol. 49: 299-303.
N	<i>Molgolaimus haakonmosbiensis</i>	CS	Portnova (2009) Zootaxa 2096: 197-213.
N	<i>Monhystera anoxyhiotica</i>	CS	Jensen P (1986) Zool Scr 15 (1): 1-11.
N	<i>Paracyatholaimus spinulosus</i>	CS	Jensen P (1985) Zool Scr 14: 247-263.
N	<i>Prochaetosoma brighti</i>	CS	Jensen P (1985) Zool Scr 14: 247-263.
N	<i>Prochromadorella papillata</i>	CS	Jensen P (1985) Zool Scr 14: 247-263.
N	<i>Rhips anoxybiotica</i>	CS	Jensen P (1985) Zool Scr 14: 247-263.
N	<i>Symploctoma brevispiculum</i>	CS	Jensen P (1986) Zool Scr 15 (2): 93-99.
N	<i>Thalassomonhystera fisheri</i>	HV	Zekely J, Sorensen M, Bright M (2006): Meiofauna Marina 15: 25-42.
N	<i>Thalassomonhystera vandoverae</i>	HV	Zekely J, Sorensen M, Bright M (2006): Meiofauna Marina 15: 25-42.
N	<i>Theristus (Penzancia) anoxybioticus</i>	CS	Jensen P (1995) J of Nematology 27 (2): 231-236.
N	<i>Theristus (Theristus) coplatus</i>	CS	Jensen P (1986) Zool Scr 15 (1): 1-11.
N	<i>Theristus (Theristus) rezaki</i>	CS	Jensen P (1986) Zool Scr 15 (1): 1-11.
N	<i>Xyulu oxyhiotica</i>	CS	Jensen P (1986) Zool Scr 15 (1): 1-11.

Table 2. List of ongoing sequencing projects

De Groot A, Derycke S, Vanreusel A

Title: Nematode connectivity between deep-sea cold seeps in the Eastern Mediterranean and the Gulf of Guinea

Main funding: HERMIONE FP7 IP

Short description: The nematode species *Sabatieria mortenseni* appears to be dominant in deep-sea cold seeps in the Eastern Mediterranean as in the Gulf of Guinea (Equatorial West-Africa). To investigate the possible connection between these different seeps, molecular analyses are performed in order to get deeper insights in the population genetics of this 'cosmopolitan' species.

Gollner S, Martínez Arbizu P, Fontaneto D

Title: Phylogeography of vent endemic dirivultid copepods: a first step into their hidden world

Main funding: ChEss Mini-Grant

Short description: COI analyses of dirivultid copepods from deep-sea hydrothermal vents

Gollner S, Martínez Arbizu P

Title: Multidisciplinary approach to unravel biogeography and diversity patterns of hydrothermal vent meiofauna in the Western Pacific

Main funding: Alexander von Humboldt Foundation

Short description: Meiofauna communities associated with deep-sea hydrothermal vent mussel and snail aggregations are studied on species level. Molecular analyses is carried out to gain insight into phylogeography.

Van Campenhout J, Derycke S, Vanreusel A

Title: Analyses of gene expression, flexibility and adaptation of *Halomonhystera disjuncta*

Main funding: HERMIONE FP7 IP

Short description: Transcriptomic analyses of deep sea (Hakon mosby mud volcano) and estuarine (Westerschelde) *Halomonhystera disjuncta*

Table 3. List of sequencing protocols

Gene: COI

Taxon: Copepoda (Dirivultidae)

Reference: Gollner S, Fontaneto D, Martínez Arbizu P (2010) Molecular taxonomy confirms morphological classification of deep-sea hydrothermal vent copepods (Dirivultidae) and suggests broad physiological tolerance of species and frequent dispersal along ridges. *Mar Biol.* DOI 10.1007/s00227-010-1553-y

Short description: DNA was extracted from single specimens in 40µl of chelex (InstaGene Matrix, Bio-Rad). For each individual, partial cytochrome c oxidase subunit I (COI) was PCR-amplified using generic primers LCOI (50-GGT CAA CAA ATC ATA AAG ATA TTG G-30) and HCOI (50-TAA ACT TCA GGG TGA CCA AAA AAT CA-30) (Folmer et al. 1994). Cycle sequencing reactions were set up using PCR primers and the GE Healthcare Illustra Pure Taq PCR beads. The final mix optimized for the PCR contained 0.5 µl LCOI, 0.5 µl HCOI, 20 µl distilled H₂O, and 4 µl of the DNA extract. Cycle conditions comprised initial denaturation at 95 °C for 5 min, followed by 40 cycles at 95 °C for 30 sec, 42 °C for 1 min, and 72 °C for 1 min, and a final extension step at 72 °C for 7 min. The PCR was run on a BioRad MyCycler Thermocycler.

Gene:COI

Taxon:Nematoda(Xyalidae)

Reference: Derycke S, Remerie T, Vierstraete A, Backeljau T, Vanfleteren J, Vincx M, Moens T (2005) Mitochondrial DNA variation and cryptic speciation within the free-living marine nematode *Pellioiditis marina*. *Mar Ecol Prog Ser* 300: 91–103.

Short description: Individual nematodes were transferred to 20 µl WLB (Worm Lysis Buffer). In order to amplify a portion of the cytochrome c oxidase subunit I (COI) gene, the primers JB3 (5'-TTTTTTGGGCATCCTGAGGTTTAT-3') and JB5 (5'-AGCACCTAAACTTAAACATAATGAAAATG-3') were used (Derycke *et al.*, 2005). The total mix before the PCR was prepared in 10 µl volumes and contained 0.4 µl JB3, 0.4 µl JB5, 0.2 µl dNTP's, 1 µl Taq buffer, 0.2 Taq lab, 1 µl MgCl₂, 5.3 µl distilled water and 1.5 µl DNA extract. PCR amplification was conducted for 45 cycles with an initial denaturation step at 95 °C for 5 min, then 30 s denaturation at 94°C, 30 s annealing at 54°C and 30 s extension at 72°C and a final extension step for 5 min at 72°C.

Gene: COI, ITS, D2D3 and COI regions

Taxon:Nematoda

Reference: Derycke S, Remerie T, Vierstraete A, Backeljau T, Vanfleteren J, Vincx M, Moens T (2005) Mitochondrial DNA variation and cryptic speciation within the free-living marine nematode *Pellioiditis marina*. *Marine Ecology Progress Series* 300: 91-103. Derycke S, Vanaverbeke J, Rigaux A, Backeljau T, Moens T (2010). Exploring the Use of Cytochrome Oxidase c Subunit 1 (COI) for DNA Barcoding of Free-living Marine Nematodes. *Plos ONE*, accepted.

DNA extraction (Nematoda)

Reagents needed:

WLB : Worm lysis buffer: 10 ml end volume

50 mM KCl: 1ml 500 mM

10 mM Tris pH 8.3: 1ml 100 mM

2,5 mM MgCl₂: 50 µl 0.5 mM

0,45 % NP 40 (Tergitol Sigma): 1 ml 4.5%

0,45 % Tween 20: 1 ml 4.5%

60 µg/ml proteinase K: 1 µl (add just before incubation)

4.05 ml in total -> add 5.95 ml bidi (end volume of 10 ml)

Make the 10 ml sterile by pushing it through a 0.2µm filter and distribute it over several sterile eppendorfs (of 1.5ml)

Store at -20°C

Method :

If worms are preserved on DESS, transfer them in sterile deionised water. Repeat this two times to remove salts. Leave worms for ca 10 minutes in water to remove salts from the interior of the specimen.

Distribute 2µl Prot K in sterile tubes of 0.5ml and keep them on ice

bring one worm in 20 µl WLB on a sterile microscope slide and cut them in two (preferable more) pieces.

pipet the WLB with the worm pieces into a 0,5 ml tube. For large worms, use two tubes each containing 20µl WLB + pieces of anterior/posterior end of the specimen.

freeze 10' (or overnight) at -80°C => ice crystals brake cell walls

incubate at 65 °C for 1 hour followed by 10 minutes at 95°C

centrifuge 1 minute at maximum speed (14.000 rpm)

use 1.5 µl for PCR

Reaction mixture (Nematoda)

2.5 µl 10x PCR buffer (15mM MgCl₂) (Qiagen)

2 µl MgCl₂ (25mM) (Qiagen)

0.5 µl dNTP (10mM)

0.125 µl of each primer (25µM)

0.125µl TopTaq DNA polymerase (Qiagen)

18.625 µl water

1 µl of template DNA is added to 24 µl of the mixture

PCR mixtures are mixed, centrifuged and incubated in a preheated thermocycler

Primers and cycling conditions (Nematoda)

COI

Primers:

Forw: JB3 TTTTTTGGGCATCCTGAGGTTTAT

Rev: JB5 AGCACCTAAACTTAAAACATAATGAAAATG

Forw: CO1490F GGTCAACAAATCATAAAGATATTGG

Rev: CO2198R TAAACTTCAGGGTGACCAAAAAATCA

PCR conditions:

94°C 5 min
94°C 30 s
54°C 30 s 35x
72°C 30 s
72°C 10 min

ITS

Primers:

Forw: Vrain 2F CTT TGT ACA CAC CGC CCG TCG CT
Rev: Vrain 2R TTT CAC TCG CCG TTA CTA AGG GAA TC

PCR conditions:

94°C 5 min
94°C 30 s
56°C 30 s 35x
72°C 45 s
72°C 10 min

D2D3

Primers:

Forw: D2A ACA AGT ACC GTG AGG GAA AGT TG
Rev: D3B TCC TCG GAA GGA ACC AGC TAC TA

PCR conditions:

94°C 5 min
94°C 30 s
54°C 30 s 35x
72°C 45 s
72°C 10 min

Table 4. List of taxonomists

Acari

Anciferova Maria

Amphipoda

Vinogradov Egor

Bivalvia

Krylova Elena

Ciliata

Sergeeva Nelli

Cladocera

Sergeeva Nelli

Copepoda

Mantha Gopikrishna (Cyclopoida)

Gollner Sabine (Dirivultidae)

George Kai (Harpacticoida)

Huys Rony (Poecilostomatoida)

Plum Christoph (Harpacticoida)

Kalogeropoulou Vassiliki (Harpacticoida)

Foraminifera

Bernhard Joan

Koho Karoliina

(Moodley Leon)

Kamenskaya Olga (Xenophyophorea)

Kinorhyncha

Bright Monika

Nematoda

Barnes Natalie

Bezerra Tania Nara

Ferrero Tim

Ivanova Kateryna

Lampadariou Nikolaos

Miljutina Maria

Miljutin Dmitry

Mokievsky Vadim

Portnova Daria

Sergeeva Nelli

Sharma Jyotsna (Chromadoridae)

Tchesunov Alexei V. (hydrothermal vent nematodes)

Polychaeta

Nelli Sergeeva

Tardigrada

Mokievsky Vadim
Sergeeva Nelli

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Table 5. Meiofauna community studies from reducing environments and part of the community analysed. C = Copepoda, N = Nematoda, P = Platyhelminthes, HT = higher taxa, all = entire meiofauna community analyzed.

habitat	site	reference	analysed
deep seep	Sagami Bay	Shirayama & Ohta 1990	N
deep seep	Barbados prism	Olu et al. 1997	HT
deep seep	Dnieper Canyon	Sergeeva & Gulin 2007	HT
deep seep	Hydrate Ridge	Sommer et al. 2007	HT
deep seep	Håkon Mosby	Soltwedel et al. 2005, Van Gaever et al. 2006, Van Gaever et al. 2009	HT, N
deep seep	Nyegga/Storegga	Van Gaever et al. 2009	N
deep seep	Gulf of Guinea	Van Gaever et al. 2009	N
deep seep	Atwater Valley GOM	Bright et al. 2010	HT
deep seep	Alaminos Canyon GOM	Bright et al. 2010	HT
deep seep	Green Canyon GOM	Bright et al. 2010	HT
deep seep	Monterey Bay, off California	Buck & Barry 1998	HT
deep seep	Blake Ridge, Atlantic	Robinson et al. 2004	HT
shallow seep	Kattegat, Denmark	Jensen et al. 1982	HT + N info
shallow seep	Isla Vista, Santa Barbara Channel	Montagna & Spies 1985, Montagna et al. 1987, Montagna et al. 1989, Palmer et al. 1988	HT
shallow seep	East Flower Garden, Gulf of Mexico	Powell & Bright 1981, Jensen 1986, Powell et al. 1983, Powell et al. 1986	HT + N info
shallow seep	North Sea pockmark	Dando et al. 1991	HT + N info
deep vent	Guaymas	Dinet et al. 1988	HT + N info
deep vent	JFR Cleft	Tsurumi et al. 2003	C
deep vent	JFR Axial	Tsurumi et al. 2003	C
deep vent	JFR Endeavour	Tsurumi et al. 2003	C
deep vent	MAR Snake Pit	Zekely et al. 2006	all
deep vent	EPR 11N	Zekely et al. 2006	all
deep vent	S EPR 17S	Copely et al. 2007	N
deep vent	S EPR 18S	Copely et al. 2007	N
deep vent	N EPR 9N	Gollner et al. 2007, Copely et al. 2007, Gollner et al. 2010	N + all
deep vent	North Fiji Basin	Vanreusel et al. 1997	N
deep vent	Iheya Ridge, Okinawa Trough	Shirayama 1992	HT + N info
shallow vent	Aegean Sea, Mediterranean Sea Jan-Mayen ridge, N Mid Atlantic Ridge	Thiermann et al. 1994, 1997	N
shallow vent	Bay of Plenty, New Zealand	Fricke et al. 1989	descriptive
shallow vent	Matupi Harbour, Papua New Guinea	Kamenev et al. 1993	HT
shallow vent	Sulawesi, Indonesia	Tarasov et al. 1999	HT
shallow vent	Deception Island	Zeppilli & Danovaro 2009	N
shallow vent		Bright et al. 2003	HT + P info
deep whale fall	Santa Cruz Basin, off California	Debenham et al. 2004	HT
shallow whale fall	East Sea	Pavlyuk et al. 2009	N

Figure 1. Map of meiofauna community studies from shallow (dark red) and deep (light red) hydrothermal vents, shallow (light green) and deep (dark green) cold seeps, and whale falls (blue).

