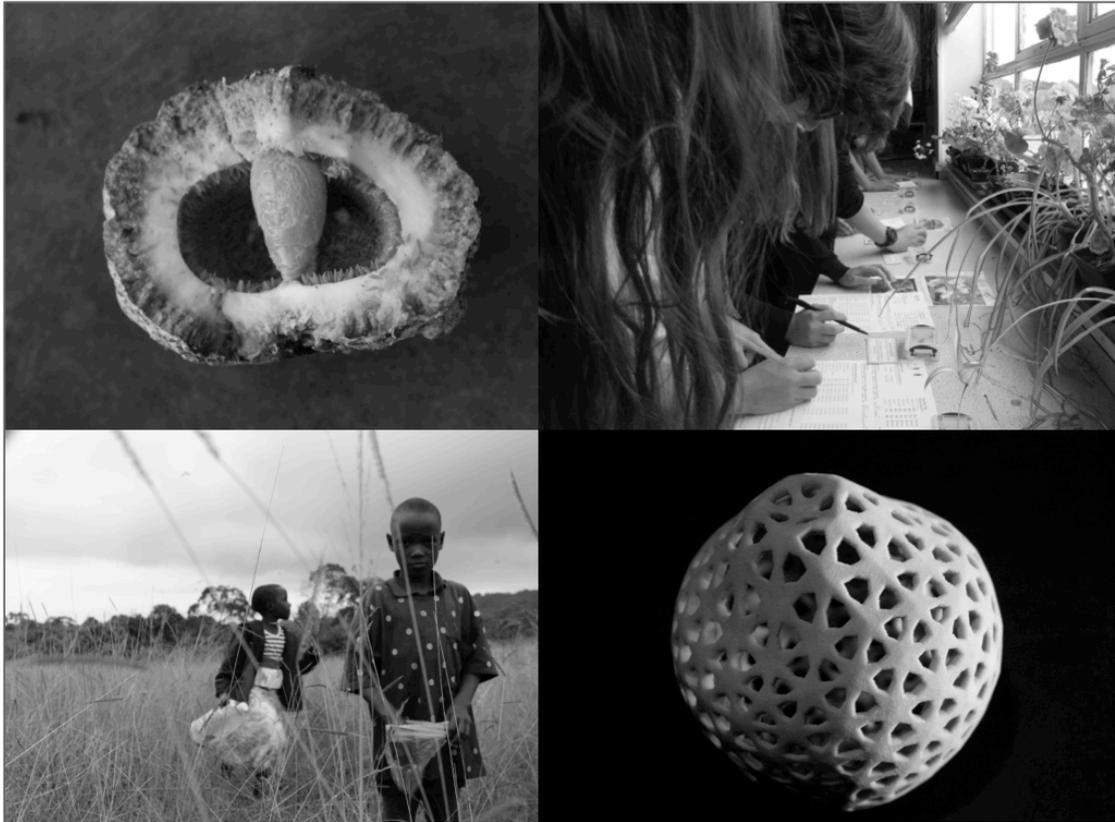


Insects as Food and Feed – an Interdisciplinary Workshop

Programme



Date: 4th December 2015

Venue: Oxford Martin School, University of Oxford, 34 Broad Street, Oxford OX1 3BD

Host: British Heart Foundation Centre on Population Approaches for Non-Communicable Disease Prevention, Nuffield Department of Population Health, University of Oxford

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(Photo credits: Josh Evans, Hannah Tranter, Susana Soares, Andrew Forkes)



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Schedule for the day

09.30 **Reception will open for registered participants**

10.00 **Welcome and introductory talks**

Scarborough, P, Payne, C, Rayner, M (University of Oxford), Nonaka, K (Rikkyo University) **Are edible insects healthier than commonly consumed meats?**

Nonaka, K (Rikkyo University) **Fieldwork with edible insects: Value and understanding**

10.50 **Session 1: Health, growth and nutrition** (Chair: **Rebecca Roberts**)

Dobermann, D (University of Nottingham and Rothamsted Research) **Innovating insect processing technology for the enrichment of traditional foods to target malnutrition**

11.20 **Poster Session A** (*accompanied by tea/coffee*)

11.50 **Session 2: Sustainability and environmental impact** (Chair: **Lilya Stoyanova**)

Quilliam, R (University of Stirling) **Insect larvae & waste management: adding value to sustainable insect production**

Soares, S and Forkes, A (London South Bank University) **Insects au Gratin**

12.40 **Insects Au Gratin demonstration**

A demonstration of 3D printing with insect paste, courtesy of Insects au Gratin (Susana Soares and Andrew Forkes). The paste is made using grasshoppers (*Sphenarium purpurascens*) collected from pesticide-free crops in Mexico.

13.10 **Lunch break.**

Refreshments: A vegan buffet lunch with locally sourced ingredients from the Organic Deli Café (Oxford), accompanied by wild-harvested insect snacks from the Hebo Café (Japan) and inspired by traditional recipes, is provided for 40 pre-registered participants.

Film showing: ‘Hungry for bugs’, a documentary film about insects in contemporary Japan, by Luis Patron for NHK World, will be shown in the lecture theatre.

14.10 **Session 3: Psychology, well-being and marketing** (Chair: **Carla Cavallo**)

Josephs, J (University of Southampton) **Capability, Opportunity and Motivation: Factors determining insect eating behaviour**

House, J (University of Sheffield) **Social and cultural factors affecting acceptance of insects as food in the Netherlands**

15.10 **Poster Session B** (*accompanied by tea/coffee*)

15.40 **Session 4:** Welfare, ethics and legislation (Chair: **Marc Schleunitz**)

Müller, A (Humboldt University of Berlin), Evans, J (Nordic Food Lab), Payne, C (University of Oxford), Roberts, R (Nordic Food Lab) **Entomophagy and Power**

16.10 **Panel discussion** with all speakers (Chair: **Rhoda Wilkie**)

Identifying future priorities in edible insect research

16.30 **Close**

Image exhibition: The following images, contributed by presenters and inspired by their research, will be displayed for the duration of the workshop:

1. Locust invasion. (Hannah Tranter)
2. Locusts for sale. (Hannah Tranter)
3. Suri, Iquitos. (Hannah Tranter)
4. Science forum exhibition. (Hannah Tranter)
5. Hellesdon. (Hannah Tranter)
6. Bee larvae ceviche at Nordic Food Lab, Copenhagen, Denmark. (Josh Evans)
7. Bush coconut, Yuendumu, Australia. (Josh Evans)
7. Catching nsenene katydids, Kalangala Island, Uganda. (Josh Evans)
8. Honey ant, Yuendumu, Australia. (Josh Evans)
9. Nsenene hunters at night, outside Masaka, Uganda. (Josh Evans)
10. Queen termite, Mbita island, Kenya. (Josh Evans)
11. Dan (co-founder of Bug Boys) talking with Jeremy Corbyn (Leader of the Opposition, UK) about edible insects (Daniel Stott)
12. Exploring the aesthetics of 3-D printed insect food. (Susana Soares & Andrew Forkes; Photo credits: Susana Soares)
13. IAG Mudam 2014 (Susana Soares & Andrew Forkes; Photo credits: Amelie Fontaine)



Oral presentations: Abstracts and Bios

10.00 Opening remarks

*Scarborough, P, Payne, C, Rayner, M (University of Oxford), Nonaka, K (Rikkyo University) **Are edible insects healthier than commonly consumed meats?***

Background/Objectives: Insects have been the subject of recent attention as a potentially environmentally sustainable and nutritious alternative to traditional protein sources. The purpose of this paper is to test the hypothesis that insects are nutritionally preferable to meat, using two evaluative tools that are designed to combat over- and under-nutrition.

Subjects/Methods: We selected 183 datalines of publicly available data on the nutrient composition of raw cuts and offal of three commonly consumed meats (beef, pork and chicken), and six commercially available insect species, for energy and 12 relevant nutrients. We applied two nutrient profiling tools to this data: The Ofcom model, which is used in the United Kingdom, and the Nutrient Value Score (NVS), which has been used in East Africa. We compared the median nutrient profile scores of different insect species and meat types using non-parametric tests and applied Bonferroni adjustments to assess for statistical significance in differences.

Results: Insect nutritional composition showed high diversity between species. According to the Ofcom model, no insects were significantly 'healthier' than meat products. The NVS assigned crickets, palm weevil larvae and mealworm a significantly healthier score than beef ($P < 0.001$) and chicken ($P < 0.001$). No insects were statistically less healthy than meat.

Conclusions: Insect nutritional composition is highly diverse in comparison with commonly consumed meats. The food category 'insects' contains some foods that could potentially exacerbate diet-related public health problems related to over-nutrition, but may be effective in combating under-nutrition.

*Nonaka, K (Rikkyo University) **Fieldwork with edible insects: Value and Understanding***

The collection and consumption of edible insects is a practice that is situated on an axis between the natural, cultural and social spheres. This presentation will cover field research undertaken on this topic since 1987, using methodology from geography, ecology and anthropology, and situated in Japan, Southeast Asia, southern Africa and Oceania.

The reasons for this research focus are that it is possible to understand the ways in which people interact with the natural environment through the ways in which 1) edible insects are chosen from

within a diverse range of insect species living within a single habitat; 2) edible insects are a food that specific to certain regions and certain societies, not something eaten everywhere nor by everyone; 2) edible insects contribute both quantitatively and qualitatively to diets; 3) people hunt, cook and gather knowledge about edible insects.

In the past, research into edible insects was likely to be considered trivial, esoteric and insignificant. When I started to work in this field, I realized that insects were not a food that was universally popular, and I was relatively surprised at the extent to which they were used as food, but I saw this in a positive, not negative, perspective.

During the following thirty years of research, I have amassed a number of case studies in this area, and learned of the circumstances of people who eat insects, their enjoyment in collecting insects even if only gathering small amounts, and the importance they place on the subtle differences in taste depending on circumstances. Through this, I have come to understand the significance of experiencing all of the above – the circumstances, the enjoyment in collection, the subtleties of taste – in practice, and I have been converted to the view that a diet that includes insects is a diet that is delicate, rich in diversity, and extensive.

Insect consumption reflects the great cultural diversity found in the way in which traditional ways of using the environment develop from an interaction between human food culture and the local flora and fauna. Thus, there are many research topics related to natural resource use, such as the subsistence strategies and complex of traditional insect eating cultures, methods of resource management, and the influences of locality and globalization.

Insect foods may be a marginal resource, but exploiting them requires people to have a proactive relationship with the insects themselves. This originates in a familiarity with insects due to their close presence. Furthermore, this mutual connection enables people to understand and appreciate the appropriate habitat, development and emotions of insects.

I hope to continue study and learn from people who eat insects about their relationship (love, taste, understanding) with the natural world.

10.50 Session 1: Health, growth and nutrition (Chair: Rebecca Roberts)

*Dobermann, D (University of Nottingham and Rothamsted Research) **Innovating insect processing technology for the enrichment of traditional foods to target malnutrition***

The presentation will outline an on-going project exploring the potential of insect flour in food fortification interventions targeting malnutrition in developing countries, particularly low iron status which contributes significantly to health problems. Supplementation with multiple micro-nutrients (MMNs) is one strategy to counter malnutrition, however results are contradictor on its effectiveness and it is an expensive intervention not sustainable over time. This project retains the food cultures of the developing country in order to develop a long term intervention. It is developing techniques to enable the enrichment of traditional staple foods with indigenous insects in flour form. Insects are high in both protein and iron and a traditional part of many diets in developing countries. At present the project is 1) examining viable bio-waste streams to feed insects on via a feeding-trial 2) conducting nutritional analysis of insects on various feeds 3) analysing the impact of processing and storage methodology on nutritional quality 4) producing a nutritionally competitive insect flour for use in food products. Preliminary results will be available. Future directions will involve a full-scale clinical trial of the impact of insect flour on nutritional status.

Bio: Darja Dobermann is a BBSRC funded PhD student at the University of Nottingham and Rothamsted Research. She has previously completed an MSc in sociological research and international development at the University of Edinburgh and BA in developmental psychology at the University of Victoria. She has a personal vested interest in development work as she spent formative years living in the Philippines. Her passion for nutrition, particularly maternal and child nutrition, was sparked through visiting scholar work at Columbia University. These factors have driven her to pursue sustainable interventions for nutrition challenges.

11.50 Session 2: Sustainability and environmental impact (Chair: Lilya Stoyanova)

*Quilliam, R (University of Stirling) **Insect larvae & waste management: adding value to sustainable insect production***

Insects possess great potential to efficiently convert waste organic matter into a high value source of protein and fat. Subsequently, producing & refining insect larvae grown on organic waste into a high quality product is currently being exploited to provide a sustainable source of feed in aquaculture & poultry systems. This win-win situation provides sustainable solutions for both waste management and food security; however, for this novel production system to be widely accepted

there needs to be robust standards for quality control & food safety and in particular the potential for the transfer & survival of human pathogens throughout this food production chain. We will introduce two projects, (i) the AQUAFLY project led by NIFES in Norway, that aims to utilise the kelp fly (*Coelopa* spp.) fed on marine substrates such as seaweed biomass, in order to tailor an insect product rich in marine omega-3 fatty acids, to supplement existing fishmeal options for sustainable Atlantic salmon aquaculture; and (ii) the ENTO-PRISE project, which aims to commercialise insect (BSF) transformation of organic wastes (e.g. food wastes & chicken manure) to benefit farmers in Ghana. In both of these projects, our role is to quantify the persistence of human pathogens (e.g. *E. coli* O157, *Salmonella*) through the insect production chain, and their survival in added value products, i.e. frass biofertilisers.

Bio: I am a lecturer in Environmental Biology, at the University of Stirling with research interests in environmental pathogen ecology, water quality, conflicting ecosystem services, sustainable agriculture & aquaculture, and sustainable disease & waste management. My research sits at the interface of agriculture and the environment and focuses on a number of sustainability and disease-related topics. Much of my work is carried out in the context of sustainable agriculture and food & water security and is underpinned by methods and theories from both the natural & social sciences, and includes a significant level of engagement with the local community and a wide range of stakeholders.

Soares, S and Forkes, A (London South Bank University) Insects au Gratin

Insects Au Gratin focuses on the future of food and explores the nutritive and environmental aspects of entomophagy (eating insects), combined with 3D food printing technologies.

The project has been investigating the possibility of using 3D dimensionally extruded insect paste filament as a method of creating foodstuffs, although the notion of printing food is not a new development, the innovation of using insect paste as a build medium is highly novel, this coupled with farming insects could create a sustainable source of food and food production for an increasing global population. Why insects? Although entomophagy is alien to the western society, people in non-western territories eat insects as part of a regular diet. Insects are very efficient at converting vegetation into edible protein, full of vitamins and minerals: four crickets provide as much calcium as a glass of milk, and dung beetles, by weight, contain more iron than beef. Farming insects generates one-tenth of the methane produced by farming traditional meat sources per kg and it uses comparatively little water.

Insects Au Gratin aims to explore and debate the potential of entomophagy as a sustainable food source as well as combining with new food production technologies and how those could affect human perception of food and technology.

Bios: Susana Soares employs design to explore future technological implications for public engagement and awareness. After completing a BA(Hons) in Industrial Design from ESAD, Portugal she graduated at MA Design Interactions in Royal College of Art, London. Her work has been published and exhibited internationally at the MoMA in New York, Science Gallery in Dublin and Southbank Centre in London. She is currently Senior Lecturer at London South Bank University.

Since Graduating in Industrial Design Engineering from Central St Martins School of Art and Design in 1990 **Andrew Forkes** has worked within the design, development and prototyping industry with a range of clients and diverse projects, clients and collaborators have included IDEO London, Concorde: Marlin lighting, The London school of Hygiene and tropical medicine and numerous others. He is currently a Senior Lecturer in Industrial Design at London South Bank University, where his research themes include the design and development of 3D printing foodstuffs, pedagogic products, and blended physical and digital design processes.

14.10 Session 3: Psychology, well-being and marketing (Chair: Carla Cavallo)

*Josephs, J (University of Southampton) **Capability, Opportunity and Motivation: Factors determining insect eating behaviour***

Insect farming has low environmental impact (FAO, 2013) and raises fewer welfare concerns than traditional western farming, yet many express reluctance to eat insects. Might this change with greater knowledge? We (Josephs and McBride) ran a preliminary study with the aim of examining: current meat eating habits, attitudes towards eating different species and reasons for avoiding eating different species. Participants were 53 undergraduate students studying the psychology of human-animal interactions. They received six weekly two hour lectures on: animal senses and cognition, farming and welfare, and nutritional comparisons of insects and meats traditionally eaten in the UK. Measures were taken at baseline (T1) and immediately after the last lecture (T2). At T1, 17% had tried insects and 50.9% would not try insects (decreasing to 35.8% at T2). The top reasons for not eating insects at T1/T2 were: “it’s disgusting” (43.4%/24.5%), “it would taste bad” (37.7%/18.9%) and “I don’t eat meat” (11.3%/13.2%). Categorisation as food increased for insects mentioned in lectures (mealworms/crickets). I will discuss the relevance of these results in the context of the COM-B model of behaviour change, which recognises ‘capability’, ‘opportunity’ and ‘motivation’

as components that must be addressed when designing interventions and policies for behaviour change.

Bio: I have been conducting a preliminary research project at Southampton University into attitudes towards meat eating, with emphasis on horse meat and insects. Last year, I lectured on entomophagy as part of the 'Human-Animal Interactions' psychology module at Southampton, and will be repeating this in November (in addition to collecting more data). I also attend science/sustainability events and sell insect products (as The Bug Shack) and gave a TEDx talk in April, which is now online. I will also be looking for funding to continue my research.

House, J (University of Sheffield) Social and cultural factors affecting acceptance of insects as food in the Netherlands

A crucial part of efforts to encourage the use of insects as food and feed in the UK and Europe is the investigation of consumer acceptance, yet relatively little has been published so far on this topic. The research that is available, which is typically grounded in a consumer or health psychology perspective, generally employs survey-based methodologies to elucidate consumer 'attitudes' about the consumption of insect-based food and feed.

This presentation argues that orthodox methods of food research are alone insufficient to fully understand consumer acceptance of new and emerging foods. Psychological research into the 'predictors' or 'determinants' of consumption behaviour often fails to acknowledge the lived reality of food purchase and consumption, and tends to treat 'attitudes' to foods as if they are both stable and amenable to decontextualized empirical investigation.

The presentation outlines evidence drawn from qualitative research conducted in the Netherlands with consumers of insect-based foods. It argues that investigation of consumer acceptance must pay greater attention to the social and cultural context in which food choices are made, and proposes that many of the psychological factors considered to be key behavioural determinants are demonstrably subordinate to more prosaic influences, such as price and availability of foods.

Bio: I am a PhD student in Human Geography at the University of Sheffield, investigating consumer acceptance of insects as food and feed in the UK and the Netherlands. My research aims to understand the dimensions of the (non-)acceptance of insect-based foods in relation to established practices of food provisioning and eating, and to elucidate what obstacles may exist to the acceptance of such foods. I am interested in the way in which certain foods are positioned as edible and others are not, and whether or not socio-demographic attributes relate to differences in levels of acceptance.

15.40 Session 4: Welfare, ethics and legislation (Chair: Marc Schleunitz)

Müller, A (Humboldt University of Berlin), Evans, J (Nordic Food Lab), Payne, C (University of Oxford), Roberts, R (Nordic Food Lab) **Entomophagy and Power**

Edible insects are the panacea of the moment, and the movement is growing rapidly. Yet as the insect ‘solution’ is scaled up, there is more focus on technical innovation and less on the structural inequalities that govern who produces, who controls, and who benefits from ‘novel’ foods being implemented in global agri-food systems. We thus find it important to ask: To what extent is the promotion of ‘entomophagy’ challenging or reproducing established power relations in global agri-food systems?

Our research question and methods are strongly influenced by our fieldwork experience in regions of the world where insects are valued foods, as well as our different disciplinary backgrounds. In our presentation, Andrew will introduce the general concept, and describe his field work in South East Asia where he began to notice patterns that gave rise to the current paper; Charlotte will outline our systematic literature review of peer-reviewed papers on edible insects; Rebecca will outline our systematic product review of edible insect products currently available on the internet marketplace; and Josh will conclude with the trends these different datasets illustrate and corroborate, and some recommendations for further research. Overall our data suggests a growing disparity between the dominant claims and observed effects of the ‘quick-fix’ approach to agri-food system challenges currently characterising the edible insects movement.

Bios: Andrew Müller is a sociologist (BA) with a main research focus on insects as food and extensive fieldwork experience in Southeast Asia. **Joshua Evans** (BA) is Lead Researcher at Nordic Food Lab, a non-profit organisation at the University of Copenhagen, that investigates the role of gastronomy and diversity in food systems. **Charlotte Payne** is a PhD candidate at Cambridge in Zoology, and is interested in traditional and emerging insect agricultural systems and their implications for human and environmental ecology. **Rebecca Roberts** (MA) is a Food Geographer specialising in the political ecology of edible insect production and consumption.



Poster presentations: Abstracts and Bios

11.20 Poster Session A

1. Müller, A (*Humboldt University of Berlin*), Evans, J (*Nordic Food Lab*), Payne, C (*University of Oxford*), Roberts, R (*Nordic Food Lab*) ***Entomophagy and Power***

Edible insects are the panacea of the moment, and the movement is growing rapidly. Yet as the insect ‘solution’ is scaled up, there is more focus on technical innovation and less on the structural inequalities that govern who produces, who controls, and who benefits from ‘novel’ foods as they become implemented in global agri-food systems. We thus find it important to ask: To what extent is the promotion of ‘entomophagy’ challenging or reproducing established power relations in global agri-food systems? We draw on evidence from academia, from industry, and from the local insect trade in South-East Asia, using a mixed-methods approach to bring these different datasets into dialogue. We collected our data in three ways: a systematic literature review of peer-reviewed papers on edible insects; a systematic product review of edible insect products currently available on the internet marketplace; and qualitative field work data used to illustrate and corroborate the trends from the two reviews. Our integrated data analysis suggests how the emerging edible insects movement is—generally but not exclusively—reinforcing the existing power relations many of its actors claim it challenges. We conclude our paper with a list of recommendations for further research to investigate the growing disparity between the dominant claims and true consequences of the ‘quick-fix’ approach to agri-food system challenges that currently characterises the edible insects movement.

Bio: See Session 4 (oral presentation)

2. Nonaka, K (*Rikkyo University*) ***V.S.O.P. of people eating insects***

Edible insects are traditionally found in many parts of the world. They are chosen by people from the range of insects living alongside them, in the same habitat.

They are not simply chosen because they require little energy to collect, are available in large quantities and are relatively easy to gather – many edible insects are difficult to find, even requiring active pursuit, and can only be gathered in small quantities.

Edible insects are used as seasonal delicacies, drinking snacks and as accompaniments to everyday meals, but also as a food enjoyed at feasts, festivals, ceremonies and parties.

For people who traditionally eat insects, the insects are gathered from the wild and are therefore considered a gift of nature. In order to harvest them they must understand the ecosystem in which they live and the way in which the environment around them is changing, moment by moment. Through this, they also have a deep understanding of the elements that contribute to the flavours of different insects.

The aim of this poster is to illustrate the vitality, speciality, originality and priorities (V.S.O.P.) of people across the world who use insects as food.

*3. Roberts, R (Nordic Food Lab) **Scaling up 'solutions': A genealogy of soy and its parallels with the incorporation of edible insects into global agri-food systems***

Edible insects are framed as traditional, neglected species which can tackle food insecurity and livelihoods vulnerability in developing nations, and serve as a panacea to burgeoning health, energy and resource scarcity challenges in globalised 'Western' food systems. Despite a long history of local wild harvesting and cultivation of insects, the dominant discourse suggests that this vision will only be achieved if edible insects are mass-produced as commodities in industrial agri-food systems, particularly through large-scale automated or technical facilities. The scaling up of edible insects into global, industrial commodity chains risks a prioritisation of technical and economic values over diverse socio-cultural and ecological ones. It also risks universalising edible insects, subsuming their rich diversity into a 'one world, one health' narrative.

This paper argues that the scaling up of edible insects as a 'solution' for global crises has historical precedents. Other traditional foodstuffs have also been industrialised into global commodities in similar ways, often with good intentions yet yielding complicated or unprojected results. The paper aims to construct a genealogy of soy, understanding how global crises related to energy, food, and feed led to new forms of power emerging both in terms of actors and geographies involved in soy production, trade and consumption but also in terms of knowledge and technologies. Convergences and divergences between the past and present will help inform the incorporation of edible insects within global agri-food systems, but also calls for a deeper analysis of structural power relations in global industrial food systems before we can claim how the life process of edible insects - and entomophagy - will play out in global marketplaces.

Bio: Rebecca Roberts is a food geographer from Oxford, UK, interested in the links between socio-politics, economics and sustainability in food systems. She researches and tells the stories behind food through journalism, international development consultancy and taste education events.

4. Schnorr, K (Friedrich-Alexander University) ***Entomophagy as a solution strategy for sustainable and regional food security- a participatory approach to identify the requirements of minilivestock***

Facing the upcoming demographic change in the world, there is need for new resources to react to the worlds demand for food. The industrial system, based on mass production, which often leads to ecological damage, social problems and food wastage can not be considered as a suitable solution. Based on research of the FAO, Wageningen University and Research Center and other institutions, entomophagy is considered as one promising possibility to achieve food security and ecological sustainability.

In my PhD thesis I will research if these propositions can be applied in a regional context using a participatory approach. First I will identify a region with a tradition of consuming insects, where mal nutrition is a problem. The next step will be to evaluate the suitability of these species for breeding, processing and selling. This step will be facilitated by interviews and questionnaires with the goal to create a seasonal calendar which includes all those information. Finally I will investigate if minilivestocks or semi-cultivation are a practical solution to face food insecurity and maintain ecological stability. Group discussions, interviews and participatory methods will play a major role to research the needs of the local community and to assess the possibility to incorporate minilivestocks or semi-cultivation in their daily schedule. The inclusion of local people, explicitly women, and their indigenous knowledge of entomophagy is a major concern in this study.

5. Swinscoe, I (University of Stirling) Oliver, D, Gilburn, A, Quilliam, R (University of Stirling) ***Exploiting insects as feed for sustainable salmon farming - identifying the risks of pathogen transfer within the production chain***

Producing & refining insect larvae grown on seaweed biomass to produce a high quality feed product has the potential to provide a sustainable source of fishmeal in aquaculture systems. However, for the sustainability of this production system there needs to be robust standards for quality control & food safety and in particular the potential for the transfer & survival of human pathogens throughout this novel food production chain. The overarching aim of this PhD project is to understand the potential risks of environmental pathogen transfer & survival via the use of insects as feed ingredients for salmon aquaculture in the North Atlantic. This project will focus on the following key research questions:

1. To what extent is the level of seaweed contamination by pathogens determined by (a) seaweed species and (b) the environment?
2. How is pathogen survival and transfer affected by seaweed processing methods?
3. Can insects facilitate pathogen survival and increase contamination within the production chain?

This interdisciplinary project is being joint-funded by The National Institute of Nutrition & Seafood Research (NIFES) in Norway, as part of the ‘Aquafly’ project and will link environmental microbiology, insect ecology, sustainable aquaculture and public health.

Bio: Isobel Swinscoe graduated in 2009 from Birmingham University with a BSc in Environmental Science, including a professional placement with the University of Canterbury, New Zealand, working on estuarine bioindicators. In 2010 she completed an MSc in Agriculture & Development at Reading University, after which she worked in waste & recycling management, pharmaceuticals and water microbiology before undertaking an MRes in Applied Marine Science at Plymouth University (2014-2015). In October 2015 she began her PhD at the University of Stirling, investigating the survival of human pathogens during the production of insect larvae for sustainable salmon aquaculture.

15.10 Poster Session B (accompanied by tea/coffee)

6. Cavallo, C (Universita degli Studi de Napoli), Matera, V C (Wageningen University)
Insects as food: A study with a choice model aimed at identifying drivers for European consumers' acceptance]

The production of high biological value proteins represents a challenge for the future. The current production techniques have a severe impact on the environment and on the availability of natural resources.

Producing food from insects allows to achieve a better efficiency of processes to produce high value proteins (Nakagaki & DeFoliart, 1991). Insects may present a sustainable alternative to cattle also because of a lower impact on the environment (DeFoliart, 1992). A big issue for this kind of consumption is represented by the acceptability from the consumers' side (Rumpold, Schluter, 2013), although the consumption of insects is already present in several developing countries (Van Huis, 2013).

A combination of socio-cultural barriers is assumed to contribute to the lower acceptability of insects-as-food in Western societies. The research question that this study addresses is: what drivers

can be identified by marketing in enhancing the acceptability of insects based products as sustainable food?

To be able to test the performance of an insect-based product in terms of perception of its sustainability on the market and register the reactions of consumers, we used for this study a choice model. The product tested were insect-based snacks.

Results suggest that insects based products are seen as sustainable; however the level of acceptance grows with the invisibility of the shape of the insects. The provision of sufficient information on the environmental benefits stemming from this type of food product is also perceived by consumers as improving their acceptance since this information make them more aware of environmental issues. The levels of willingness to buy the product are quite low, as expected. As shown in the literature (Tan et al., 2015) efforts are still needed in order to raise the awareness of the sustainability of this type of consumption in Western Countries.

Bio: I'm Carla Cavallo, a PhD student from Agricultural Sciences department of the University of Naples "Federico II". The main topic of my PhD thesis is the preferences of consumers towards olive oil products, which I'm investigating using several qualitative and quantitative methods.

I approached the topic of edible insects during my master in Management, Economics and Consumer Behavior at Wageningen University, where this topic is widely debated. Now I'm developing this topic on my own, besides the main studies for my PhD thesis, with an assistant professor from Wageningen, Valentina Materia. We already studied the issue through the means- end chain method, now we are going further in depth using more quantitative methods.

*7. Kamimura, N (Office Transet) and Nonaka, K (Rikkyo University) **Welcome to HEBO Café: Reframing Traditional Japanese Insect Cuisine***

In Japan, 'hebo' (the colloquial name for *Vespula flaviceps/shidai*, a species of social wasp) have a long history of being used as food. Rearing colonies of these wasps, and discovering wild nests in the mountains, are popular recreational activities, and there are many seasonal dishes made with 'hebo'. This is known as 'hebo culture'.

However, due to aging and depopulation, it is feared that the number of leaders of this culture is in decline. A diverse repertoire of food items is an important asset that reflects the richness of food culture. In order to ensure the continuation of this 'hebo culture' that is so familiar to local people, it is necessary for those who have never tried 'hebo' to learn about it and to taste the foods.

Therefore, based on local understanding and traditional recipes, we have developed a cuisine that is accessible even to those who are resistant to eating insects.

The aim of the ‘hebo café’ is to create a place that will offer this cuisine, which will also facilitate the sharing of information on edible insects and local food culture, with a focus on ‘hebo’.

Bio: After looking after her mother who suffered from cancer, Ms. Kamimura, who is often known as ‘Kami-ne-san’ (lit: ‘Elder sister Kami’), decided to create food and foodways in order to promote the happiness that food can bring. Through her career as a lecturer, she has worked to tailor diets to individuals. She encourages sustainable rural development by creating interrelationships between urban communities and local food culture. She has collaborated successfully with small scale producers, and has an extensive network of contacts in this field. Currently, she is particularly interested in the potential of insects as a food ingredient, and also in wild-caught meats and under-utilized marine resources such as starfish.

8. Verneau, F, La Barbera, F, Kolle, S, Amato, M (University of Naples), Del Giudice, T, Grunert, K G, ***The effect of communication and implicit associations on consuming insects: An experiment in Denmark and Italy***

It has been widely noted that the introduction of insects in Westerns' diet might be a promising path towards a more sustainable food consumption. However, Westerns' are almost disgusted and sceptical about the eating of insects. In the current paper we report the results of an experiment conducted in two European countries—Denmark and Italy—different for food culture and familiarity with the topic of eating insects. We investigated the possibility to foster people's willingness to eat insect-based food through communication, also comparing messages based on individual vs. societal benefits of the eating of insects. Communication proved to be effective on intention and behaviour, and the societal message appeared to be more robust over time. The communication effect is significant across nation, gender, and previous knowledge about the topic. In addition, we investigated the impact of non-conscious negative associations with insects on the choice to eat vs. not eat insect-based food. Implicit attitudes proved to be a powerful factor in relation to behaviour, yet they did not impede the effectiveness of communication.

Bio: In 2013 I obtained my Master's degree in food science and nutrition. Now I'm a Doctoral student in Agricultural and Agri-Food Science an the Department of Agricultural Science of the University of Naples Federico II. My field of study is the sustainability of food consumption, especially from the consumers' perspective.

9. Josephs, J (University of Southampton) Perceptions of animals and choices of meat to eat: A cohort study

Insect farming has low environmental impact (FAO, 2013) and raises fewer welfare concerns than traditional farming of poultry and cattle, yet many express reluctance to eat insects. We investigated whether education about the benefits of eating insects might change attitudes and behaviours. The study examined current meat eating habits, attitudes towards eating different species and reasons for avoiding eating different species. Participants were 53 undergraduate students studying a psychology module on human-animal interactions. Students received six weekly two hour lectures on animal senses and cognition, farming and welfare, and nutritional comparisons of insects and other meats. Measures were taken at baseline and immediately after the last lecture. At baseline, 17% had tried insects and 50.9% would not try insects (decreasing to 35.8% after lectures). The top reasons for not eating insects were: “it’s disgusting”, “it would taste bad” and “I don’t eat meat”. The categorisation of insects as food increased for insects that were mentioned in lectures (mealworms/crickets). I will discuss the relevance of these results in the context of the COM-B model of behaviour change, which recognises ‘capability’, ‘opportunity’ and ‘motivation’ as components that must be addressed when designing interventions and policies for behaviour change.

Bio: See Session 3 (oral presentation)

10. Schleunitz, M (Humboldt University of Berlin) Communicating science and raising public awareness of edible insects by a scientific comic

Abstract We want to shed light on the interdependencies between human nutrition and environment, and thus, bring out the impact that humans have due to their interactions while utilising resources. One of these resources we focus on is phosphorus, as it is a resource that cannot be substituted and is non-renewable. Phosphorus is the leitmotif of the comic, as we e.g. show where and how phosphorus exists naturally, and where and how phosphorus is utilised in the chain of food production (fertiliser, product, food additives...).

As we want to point to how individual consumption can, due to globalisation, affect areas or resource flows around the world, we undertake an imaginary trip around the world. Each chapter of the comic takes place in another country, where we outline specific topics in terms of nutrition and resources. The comic is meant to be participative, thus we have a real and existent character in each country that we are in touch with and on whom living the narrative is based.

Bio: I (Marc Schleunitz) did my master thesis on consumer perceptions of edible insects at Freie Universität Berlin. I will present the (scientific) comic as a means to introduce the topic of edible

insects to a wider public, which might help to foster the establishment of the topic in the public perception. But I also look forward to general discussions about science communication amongst the participants.

*11. Sogari, G (Parma University) Menozzi D., Mora C. **Intention of eating Edible insects: a TPB model approach***

After having published my book about entomophagy (with interviews to the main worldwide experts in communication of such topic), in the last months I started, with the collaboration of my supervisors and other students, to explore the perception and attitude towards eating edible insects and food based products.

So far we have done gathered data through the submission of questionnaire with Italian consumers (mainly students and young people) and tasting sessions (with real insects food products) at the University and other location (i.e. at the International exhibition of insect last April in Modena). We have preliminary results, which are helping us to design a questionnaire in order to develop a TBP model (Theory of Planned Behaviour), a theory that links beliefs and behaviour (Ajzen, 1975). Through this experiment we will investigate the intention to eat a chocolate bar made with cricket flour. Results will give insights on how is the perception of the introduction of new food products in the diet of the Western countries, with possible socio-demographics differences

Bio: I hold an MSc in Food Science at Parma University and a PhD at the Agrisystem Doctoral School at the Università Cattolica del Sacro Cuore of Piacenza. Currently, I am a research fellow at the University of Parma and my main research activities have been focused on sustainability in the agri-food sector, consumers' behaviour, food labelling and certification.

In recent years I collaborated with the Qualivita Foundation in Siena doing preparation of publications on traditional food products (PDO, PGI and TSG). Finally, recently, I published my first book, co-authored with Paul Vantomme (FAO expert about entomophagy), entitled "A tavola con gli insetti" (Mattioli1885, 2014) in which I explore the issues related to using edible insects as a source for human and animal consumption

*12. Stott, D, **Bug Boys***

Bug Boys is a business startup who are going to normalise the practice of entomophagy. Our mission is to encourage consumers to eat healthy and sustainable whilst expanding their palate to discover forgotten tasty flavours. Currently we are selling Cricket Flour and our insect range will expand to a range of flours and foods. The context of this poster will cover the challenges and

uncertainties facing edible insect businesses in the UK, and ways in which we can overcome these and have a positive impact and thrive alongside valuable research and social projects. Discussed will be the areas in which businesses like Bug Boys need assistance with and why. And how differing parties can implement effective collaboration to ensure momentum is not lost. All this shall encompass what is happening worldwide and how the UK can be a key player in the edible insect field. Points also will be raised on how not to put off consumers to ensure insects are seen as delicious food.

Bio: I am Dan Stott, the Co-founder of Bug Boys and currently I'm reading geology at the University of Brighton. I have a passion for sustainability and making the world a better place. I have been close to insects for most of my life through my lizard who I fed crickets, locusts and mealworms to. And after the realisation of knowing that insects can have a positive impact on the world through watching a documentary at the beginning of 2013, it became a no brainer that I wanted to pursue a value adding project.

*13. Tranter, H (University of Cambridge) **Insects Creeping into English Diets: Introducing Entomophagy to School Children in a Provincial Town***

Abstract: There are a growing number of developments that aim to introduce insects, through various distinct forms, into Western diets. Thirteen interviews were carried out and provided an insight into the opinions and visions of people working across different entomophagy projects and disciplines. Moreover, a total of 368 questionnaires were collected from five secondary schools in Norwich to explore how these visions and developments apply to a specific segment of the English population. The interviews highlighted that political frameworks and mass production strategies need to be redefined to include not only quality characteristics but also economic, social and environmental sustainability. Such supply forces must work alongside demand approaches if edible insects are to be recognized as a part of the English food culture. The data collected and its analysis revealed how information and education, as described by Ajzen's Theory of Planned Behaviour (1985), cannot independently bridge the gaps between attitude and behaviour regarding food choice; a number of sensory, psychosocial and external factors must be considered for the successful incorporation of insects into English diets and ultimately for food citizenship. This paper concludes on the importance of targeting children through both research and education and exposes entomophagy as bait for improved food education.

Bio: Working on the Natural Capital Leaders Platform at the University of Cambridge Institute for Sustainability Leadership, Hannah supports businesses through improved natural resource management and subsequent business opportunities. Hannah previously managed the Green Impact Project at the University of Kent after completing an MSc in Sustainable Agriculture and Food

Security (University of East Anglia). Hannah also holds a BSc in Environmental Sciences (University of Southampton) and gained hands-on experience in several projects; she interned for WWF Madagascar on a Holistic Conservation Programme as well as for an agroforestry project in the Peruvian Amazon.