



TECHNICAL CONSULTATION MEETING  
23-25 January 2012, FAO, Rome, Italy

**Assessing the Potential of Insects as Food and Feed in  
assuring Food Security**

SUMMARY REPORT



*Cover Photograph:* Group picture of the participants on the rooftop of FAO Headquarters, Rome

# Assessing the Potential of Insects as Food and Feed in assuring Food Security

## SUMMARY REPORT

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# Objectives of the meeting

On the following topics: Insect ecology and biology, farming insects, insects for livestock- and cattle feed, nutritional aspects, processing and trade, food and feed safety, communication and consumer attitude, marketing, policies and food security

1. Map the state of the art and identify knowledge gaps.
2. Elaborate an Action Plan to get insects as food/feed sources higher on the agenda of (inter-) national food/feed related agencies/ what needs to be done and by who/when/how.

# Executive summary

The expert consultation “Assessing the Potential of Insects as Food and Feed in assuring Food Security” took place from 23-25 January 2012 at FAO’s headquarters in Rome, Italy. Jointly organized by FAO and Wageningen University with financial support of the Government of the Netherlands, the meeting aimed to open a dialogue and foster an exchange of information and expertise on the potential benefits of using insects for food and feed as part of a broader strategy to achieve global food security. A total of 37 experts from international agencies, scientific institutions and private sector stakeholders, together with staff from relevant FAO disciplines (nutrition, aquaculture, livestock, veterinary science, food safety, forestry, biodiversity and nature conservation) attended the meeting. These experts and entrepreneurs—specialized in different aspects of insect rearing, plant protection and food engineering—together mapped the state of the art and identified knowledge gaps along the following thematic topics: insect ecology and biology, farming insects, insects as livestock-and fish feed, nutrition, processing and trade, food and feed safety, communication strategies, and policies to achieve food security. Critical baseline data for each of these thematic areas was compiled and reviewed through plenary presentations and through further discussions in working groups ([list of presentations and summary notes of the working groups](#)). In addition, participants proposed an [Action Plan](#) to move insects as food/feed sources higher on the agenda of [inter-] national food/feed related agencies.

**Insect ecology and biology** was reviewed by region: Asia – Pacific, the Americas, and Africa. The presentations showed great variation across the world on how insects are produced and utilized as food. Indeed insect consumption varies greatly by country and is often a matter of food preference. In some countries like Thailand, demand for edible insects increases as living standards improve. The vast majority of insects for food are harvested from wild populations. In turn promoting its consumption might unleash unintended consequences, such as overexploitation of certain insect species. Key priorities in this domain are: managing and conserving ecosystems, developing sustainable harvesting practices, assessing the impacts of climate change, making an inventory of traditional knowledge, documenting ethno-taxonomical practices with data that includes not only insects but all edible arthropod species, and conserving the gene pool.

**Farming insects** for food is currently practiced on a rather limited scale. In temperate zones, insects are reared by companies who sell them as pet or fish feed. Farming insects at the household level occurs mainly in South East Asia. In Thailand alone, there are some estimated 20 000 insect “farmers” who mainly rear crickets and palm weevils. Key bottlenecks for insect farmers are the availability of low cost insect feed (alternatives for expensive chicken feed), control of insect sale price by middlemen, lack of knowledge on insect pathology and inbreeding in rearing systems, lack of information and support from extension services, and lack of cooperation, networking and communication among producers.

**Mass production at an industrial scale** was defined as producing one ton/day or more. Major challenges are: selecting suitable insect species and strains, finding cheap rearing substrate (if possible by utilizing organic waste side-streams),

managing diseases and setting up sanitation procedures, producing a constant supply, developing innovative production technologies with cost-effective production systems, increasing mechanization, safeguarding animal welfare (ethical concerns), elaborating an industrial code of practices/standards and finally, quality assurance. Setting up an international body of insect producers was considered a necessity.

**Raising insects for livestock and fish feed** was deemed to have great potential in the short term, mainly because of the urgency to find a replacement for increasingly expensive fish meal and soybeans. Insects are being recognized by the feed sector as a promising alternative protein source, which will likely lead to easy market acceptance. Major considerations are: selecting the most suitable insect species or strains, producing insect proteins cost effectively, reliability and maintaining a constant supply of high quality insects, assuring feedstock safety when rearing insects on organic waste and manure, establishing a regulatory framework, developing [inter-] national industrial standards on sanitation, marketing and production, and finally, developing automated processing technologies to turn insects into feed.

**The nutritional value** of insects depends on species, insect stage, and the type of feed for insects. The nutritional contribution of insects to diets in traditional and informal food systems is poorly documented. It is known that protein quality is generally high, similar to other animal meat sources. Fat content is variable, but in general a good source of essential polyunsaturated fatty acids. Insects are also a significant source of iron, zinc and vitamin A. This is important in light of the fact that some 2 billion people are deficient in zinc, 1 billion have iron-deficiency anaemia, and vitamin A deficiency affects some 250 million people, mainly young children and pregnant women in developing countries. However, bio-availability of minerals, in particular iron, needs to be demonstrated. More research is also needed on food hygiene standards, and allergies caused by insects. Nutritional compositions of several insects have recently been added to the international [INFOODS](#) Food Composition Database for Biodiversity.

**Insect food processing and trade.** Issues involved food for human consumption and covered topics like: preservation and improving shelf life of raw/processed food products, processing methodologies, standardization of products to facilitate their trade, and safety issues like setting up tracking and tracing systems. [HACCP](#) (Hazard Analysis Critical Control Points) as a preventive food safety system, for example, needs to be incorporated into international and national insect food legislation to reduce the risk of hazards. It was also believed that standard practices may be employed from similar industrial sectors such as meat, fish and crustacean processing.

**Food Safety.** Participants were briefed on the function of [Codex Alimentarius](#) and on how food safety standards, guidelines and code of practices for insects might develop through its existing horizontal/vertical committees and ad-hoc intergovernmental task forces (see “Discussion paper for new work on a regional standard for edible crickets and their products” ([CCASIA17](#))). The procedures of [The European Food Safety Authority](#) (EFSA) regarding insects used as food in the EU would require a pre-market safety evaluation and EFSA may be asked to carry out a risk assessment.

**Communication Strategies.** A critical activity within a communication strategy that aims to promote the role of insects as a viable option for improving food security is to encourage serious media coverage. This can be achieved by providing validated data and content-rich textbooks on the subject, based on respectful understanding and intercultural competency. Media coverage must permeate all levels of society—from schools and government agencies to professional organizations. Media outlets are also a powerful means to establish projects and programmes which maximize food /feed production and improve health, lives and livelihoods, while at the same time minimize energy and environmental costs.

**Policies for food security.** Insects for food and feed cope well within the four “[food security dimensions](#)” (availability, access, utilization and stability). Policies and investment programmes for edible insects should aim to play on these four dimensions of food security for positive outcomes.

**Action Plan.** On the third day of the expert consultation, participants elaborated an [Action Plan](#) aimed at moving insects as food/feed sources higher on the agenda of [inter-] national food/feed related agencies. Through five concurrent working groups, participants formulated recommendations for developing strategies and actions addressed at the private- and public sector as well as FAO. The groups also made recommendations for developing communication strategies and provided advice for convening a global conference on insects as food and feed.

- Key action points for the [private sector](#) included: creating an international industry association with secured funding, developing a position paper to influence policy development, writing a roadmap for the insect protein technology and industry, liaising with regulators, policy makers, scientists and NGOs, and developing quality standards for products (e.g. through self-regulation and certification).
- The strategy and proposed actions for the [public sector](#) focussed on: [inter-] national networking for information exchange, supporting research, and improving awareness and collaboration among relevant ministries (health, agriculture, environment, education and research according to country context).
- A wide range of recommendations were compiled to address [FAO's](#) role in the sector, such as: acting as a ‘centre of excellence’ for information exchange and networking among its member countries, recognizing ‘edible insects’ as an interdisciplinary/ cross departmental activity and as an agenda item for its relevant [Committees](#), and taking the lead to develop a multi-donor trust fund to facilitate further work, including field projects in interested member countries.
- It was agreed that an effective [communication strategy](#) needs to differentiate between insects as food and as feed, and also minimize sensationalism surrounding insect consumption by using well-documented literature to increase credibility. Among the elements to be considered for developing effective communication strategies for governments, international agencies, the private sector and NGOs are: tailoring targeted messages for different audiences, identifying incentives for using insects as food, using success stories and best practices/experiences to promote the consumption of insects, involving (local) media to raise awareness, creating a communication tool kit

on the importance/opportunities of insects as food and feed, and seeking endorsements from celebrities to improve the credibility of the sector.

- Logistical and technical considerations were compiled surrounding the possibility of convening a global conference on edible insects, most probably in 2014. Decisions regarding a possible venue, dates, and a potential programme will most likely rest with the preferences of potential conference donors. FAO was asked to compile a proposal and seek interest from potential donors.

### **Concluding remarks**

What began as a small effort in FAO's Forestry Department to recognize traditional livelihood practices and sustainably managed habitats is unfolding into a broad based effort to look into the multiple dimensions of insect gathering and rearing. A growing body of evidence has made it increasingly apparent that insects offer unique opportunities to not only serve as important sources of food and feed—with minimal environmental costs—but to contribute to alleviating malnutrition. This expert consultation—which convened to explore the viability of developing insects as a future source of food and feed—proved to be a significant step forward on the global stage in enhancing awareness, networking and sharing information. The proceedings of this expert consultation will be included into a FAO technical position paper on edible insects and expected to be available by mid 2012.

# Action Plan

Participants developed an Action Plan structured along five working groups aimed at moving insects higher on the agenda of [inter-] national food/feed related agencies. Recommendations were formulated for developing strategies and actions addressed at the private- and public sector as well as FAO. The groups also made proposals on how to develop a communication strategy and suggested convening a global conference on insects as food and feed.

Here below is a summary of the key recommendations compiled by each stakeholder group, followed at the end by a full list of proposed actions as elaborated by each working group during the meeting.

## ***Private Sector***

- create an international association of producers of insects as feed with secured funding,
- develop a position paper to influence policy development,
- write a roadmap for the industry on insect protein technology,
- set up a communication network between regulators, policy makers, scientists and NGOs, and
- develop product quality standards (e.g. pro-active self-regulation, certification).

## ***Public Sector***

- strengthen [inter-]national networking for information exchange,
- support research and relevant education/ curriculum development,
- improve awareness and collaboration among relevant ministries (Health, Agriculture, Environment, Education and Research according to country context).

## ***Food and Agriculture Organization of the UN (FAO)***

- become a “centre of excellence” for information exchange and networking among member countries,
- publish a technical paper outlining the state of the art on practices, opportunities and challenges of gathering and rearing edible insects,
- recognize “edible insects” as an interdisciplinary and cross-departmental activity and as an agenda item for its relevant Committees,
- take the lead to develop a multi-donor trust fund to facilitate further work by FAO and relevant stakeholders, including the development of field projects in interested member countries,
- develop a proposal for convening a global conference on edible insects, in close collaboration with relevant stakeholders and interested member countries,

- create a “tool kit” for communication/media staff on the importance of insects as food and feed.

### ***Communication strategy***

- tailor targeted messages for different audiences,
- identify incentives for using insects as food,
- promote success stories and best practices,
- involve the (local) media to raise awareness, and distribute a tool kit to support communication efforts which describes the importance of gathering, rearing and consuming insects as food and feed,
- make a clear distinction between insects for food and for feed – carefully articulating different messages for each of these,
- seek endorsements from celebrities to enhance credibility,
- play down the sensationalist aspects of insect-eating by assembling a credible body of literature and “media-friendly” information.

### ***Towards a global conference on edible insects as food and feed (2014)***

- Participants compiled a comprehensive list of logistical and technical considerations to be made in light of a possible global conference on edible insects, most likely to take place in 2014. Decisions regarding a possible venue, dates, and a potential programme will most likely rest with the preferences of potential conference donors. FAO was asked to compile a proposal and seek interest from potential donors.

## ***Un-edited compilation of issues and proposed actions as elaborated by each working group during the meeting***

### **Strategy and action plan for the private sector**

- The uptake of insects as a novel source of food and feed will require the development of a new business sector.
- Business success will depend on:
  1. Developing Successful Products
  2. Creating a Market demand
  3. Assuring Profitability (reducing production costs to obtain competitive prices)
  4. Developing suitable Business Models
  5. Managing Regulatory Hurdles (food and feed safety)
- Key action points for the private sector
  1. Create an international insect protein industry association and secure funding for its functioning
  2. Write a position paper and outlook paper that will allow to influence policy development
  3. Write a roadmap for industry to develop the insect protein technology
  4. Liaison private sector with regulators/policy makers and scientists (“Golden Triangle” concept). . The word quadrangle was mentioned as well, meaning applied research and maybe NGO’s).
  5. Participate in creating a multi-donor trust fund with the FAO
  6. Provide a platform for sharing knowledge, information and experience
  7. Develop a list of research needs
  8. Write collaborative research grant proposals with international partners
  9. Develop product quality standards (self-regulation, viz. pro-active setting up own standards, certification)

### **Private Sector – raw meeting notes**

- Who are we?
  1. Need to actively involve small producers in developing countries
- What do we do?
  1. Do we produce protein or transform protein?
  2. Do we need protein or amino acids (transform insects)?
- Where do we want to go?
- Why do we want to do this?
  1. What is the business plan and business model?
- How are we going to get there?
  1. Sharing knowledge should not be a problem (cfr. agricultural farming). The challenge is how to become the best. Everybody can run, but how to run faster than the others.
- Action points
  1. Involve specialists and companies from developing countries
  2. Place to test the end-products (e.g. testing suitability of insect products as animal feed, feeding trials, experimental farms (e.g. University of Stellenbosch)).
  3. Regulatory hurdles to perform animal feeding trials.
  4. Communication with research institutes so they know what we want to know.

5. Communication with regulators
  6. Different tracks
    - Insects for feed
    - Insects for pet food
    - Insects for human food
  7. Regulatory issues
  8. Funding issues
- Sustainability
    1. People: job creation, social aspects, food security, local production,
    2. Profit: economic development,
    3. Planet: carbon footprint, climate-smart production,
  - Financing private initiatives
    1. Family companies
    2. Private investors, business angels, venture capital
    3. Subsidies
  - Key Challenges to develop a successful business
    - i. Create a market demand
    - ii. Profitability
      1. Production cost
      2. Market price
    - iii. Manage regulatory hurdles
    - iv. Product quality
    - v. Reliability/ Availability
    - vi. Scalability
    - vii. Finding suitable personnel
  - Identify suitable species
  - Animal feed
    1. Processing insects into animal feed.
    2. Availability of high-protein feed is in decline. Needs for alternatives are increasing. Can insect protein help to increase yield of animal production.
    3. Knock-out criteria for the feed industry :
      - Cost
      - Regulations
  - Human Food
    - Development of insect-based food products
  - Pet Food
    - Strategic view of pet food industry: Increasing need for high-protein feed for pet food industry. Want to become independent from human food chain. Do not want to compete with human food chain. Use byproducts, underutilized materials, etc.
    - Feed safety is very critical, sensitive for pet food
  - Look for additional benefits (health benefits, sustainability) to create demand
  - Involve the entire value chain
    1. Industries that are looking to turn byproducts and waste streams into value.
    2. Collaborate, together with other stakeholders, with legislators (e.g. EFSA, FDA ...) to amend existing regulations and pro-actively participate in the development of new regulations.
    3. Scientists
    4. Pet food industry, fish feed industry, animal feed industry, human food industry
  - New business models
    1. Small-scale businesses in developing countries

2. Fully integrated production (cfr. Industrial ecology) to produce multiple revenue streams
  3. Cfr. Development of cell phone market in Bangladesh, Taro Nano
  4. “Innovating at the base of the pyramid”
  5. Franchising
- Intellectual Property
    - o Patenting
    - o How to share knowledge?
  - Mass-Rearing Technology
    - i. Tap into existing knowledge about insect production from other industries (biological control, Sterile Insect Technique, silkworm production, aquaculture, ...)
    - ii. Finding the right personnel is a challenge
      1. Training of insect production people
    - iii. Scalability of production
      - Pilot plants
      - Production capacity >1-5 ton/week
      - Up scaling from laboratory scale production to industrial scale.
  - Technology Push vs. Market Pull
  - How to develop the market? ([Blue Ocean strategy](#))
    - o Prototypes, Proof of concept
  - Separation of waste streams is critical to make them suitable as a feedstock source (e.g. leftovers from canteens)
  - Both the end-product as well as the entire production of insects should be sustainable.
  - Should avoid the use of controversial words like “waste”, insect meal,...
  - “Yellow biotechnology” : based on insects
  - Entomo-processes: Bioconversion. Bioremediation.
  - Entomo-products: food, feed, pharma, pollinators, biocontrol agents,...

## Strategy and action plan for the public sector

Action plans for each sub sector in the public sector: worldwide, research, policies, FAO, knowledge transfer organizations

### 1. Networking: local, national and international (action by every agency and by FAO at the international level)

- open internet worldwide database of stakeholders (research, international organizations, all relevant individuals): based on individual contacts
- be aware of difficulties of communication because of language barriers and culture differences
- communication
  - use of information from this meeting for convincing the local environment of the participants,
  - convince transfer organizations by worldwide success stories for introducing insect in food and feed industry

### 2. Research

- worldwide database on edible insects: not only Wageningen university, but an integration of different databases around the world: linking Lincaonet with Asian-based upcoming databases.
- Standardized protocol to include new insects in this database,
- Digital platform of researchers all over the world – opportunity for young researchers to be known and communicate
- Addressing the knowledge gap

- What species are consumed
  - How local people collect consume and use insects
  - Sustainability of supply (wild harvesting and/or farming)
  - Market trade
  - Mass-rearing techniques
  - Food policy on edible insects
  - Insect feed
- how to collect funding for research
- communication to rural people by local seminars: factsheets information documents, advertise on local news papers (example of food fairs: “Wageningen,city of insects”), collaboration with musea
- developed world: communication through media newspapers, musea, education in schools (also high schools and universities), zoo
- communication between researchers; refer to network and research database

### 3. Policy- Ministries

- identification of ministries ; health, agriculture, environment, research and education – depending on the Countries
  - o visits and networking activities
  - o support of FAO
  - o provide right and complete information about insects
  - o funding sources

### 4. FAO

- Recognize edible insects as a food for everybody. Not just an indigenous food. Insects are not a food for just poor people only.
- Better linking regional offices with headquarters, also not only Asian regional offices, also Africa, L. America and Near East offices to become involved
- spread the idea of insects as food among all departments at FAO HQ
- at FAO Committees (by representatives of FAO members) have the topic of edible insects on the agenda (eventually linked with topics such as: climate change, genetic resources, feed regulations, ...)

### 5. Transfer organizations (technical centers, federation of food industry)

- convince with worldwide success stories for introducing insect in food and feed industry

### 6. NGO

- need of technical information by collaboration with different actors

## **Strategy and action plan for the FAO**

Points to address:

- Nutrition: keep updating the food composition database INFOOD Food composition table
- Biology and ecology: list of species, now the biggest one is at WUR, in the long run it could be based at FAO
- Advice from/to private sector and small scale producers: give information how to rear insects, obtain website portal to collect farming information, enhance standardization (eg weblog to discuss free about subjects to informally exchange knowledge: e.g. collecting eggs from insects). Outcome of that website: make publication together on how to rear insects for feed and food.
- Insects are in Forestry Department, but we should consider it as real food

Insects are not easy to place in the structure of the departments: where does it belong? Where is the expertise in FAO?

- FAO: Work harder to build more constituency inside FAO by awareness to other departments
- Optimal communication between stakeholders, FAO and governments needed:
  - FAO: if insects are seen as a food: successful communication to governments is possible
    - Recognition: recommendations of this meeting need to go to governments→ this comes back to FAO to member state meetings at FAO.
    - FAO needs to come with a comprehensive outlook paper on the topic,
    - Web portal on feed: to include articles on edible insects. Use the good FAO contacts with feed industries to further networking.
    - Governments could send APO(s) that can work on this for two years
    - FAO to widely disseminate the proceedings on this meeting (as a web downloadable document for convincement of different agencies including governments).
    - FAO representations can be contacted for projects proposals and to address case studies information: TCP program can be used ([http://www.fao.org/tc/tcp/tcp\\_facility\\_en.asp](http://www.fao.org/tc/tcp/tcp_facility_en.asp)). See example of the Lao TCP.
    - FAO food safety: global initiative for scientific advice, call from FAO to stakeholders to inform governments
    - Stakeholders on edible insects should come up with case studies with a good impact to convince policy makers, and forward these stories to FAO
- From regional perspectives of FAO: information exchange, cross sectional corporation, need more projects to keep public attention and demand of projects come from countries
- Linking to other UN Organizations, also to get World Bank on board to help with funding, UNIDO (work in mass rearing)
- Need for a Multi-donor-thrust-fund to facilitate work at and by FAO

## Strategy and action plan for communication strategies

by governments, (inter-)national agencies, private sector, databases, networking, etc.)

Summary of Main Points:

- Targeted messaging for different audiences
- Incentives for using insects as food
- Who are the messengers for this message/these messages?
- Use of Stories – success stories, experiences,
- Availability of media to use in messaging (FAO? – photos, videos, internet, comic (Manga, from Japan) etc.) – formulation of a tool kit for communication the importance/incentives of insects as food and feed – who will make the toolkit?  
COULD FAO DO THIS?
- Endorsements and credibility – organizations, celebrities, etc.
- Short eloquent messaging
- Environmental – be selective
- Differentiation of food vs feed – different message for each of these
- Language and acceptable terminology, different for different audiences?
- Representation of the product – less sensationalism, credibility of information sources

Meeting Notes:

- Communication officer for Forestry Department (FAO) was involved with Entomophagy in Laos project – wants to do outreach on this topic
- Coordinated lobbying effort
- Who is most appropriate to take on the various communication roles (FAO? NGOs? Industrial organizations? Universities?
  - Education/Schools/Universities:
    - Curricula/courses? - integrate into standard knowledge for acceptance
    - Forensic Entomology might be a model to get students interested?
  - Sustainability: Environmental and ocean preservation organizations – work closely with these
  - Practitioners in sterile insect technique?
  - Collaboration with other agencies (UN agencies?, etc.) who may have overlapping interests
- Media:
  - Information / imagery sharing – photos, videos, powerpoint presentations, internet content, etc. for use by the community at large in their own communication activities
  - FAO should create a tool kit for messaging on edible insects !
  - Focus message/messaging
  - Formulate key incentives for eating insects and using them in food
  - Unified consistent message
  - Show happy people eating insects
  - Important to get press (National Geographic, etc.) on success stories
  - Accuracy is important
  - Local and regional restaurant shows
  - Other venues?
  - Internet
  - Television
  - News
  - FAO logo can be used on information products as an endorsement – there is a screening process for this
- Messaging:
  - Positive messages
  - Unified messaging/marketing campaign:
    - Especially important in the early stages
  - Credibility of the origin of the message is critical
    - Third party credibility
    - Be prepared to respond to negative reports by other groups
    - Be prepared for attacks from competing industries
  - Whole insects or insect based products? Maybe better for PR to lean toward insects as an ingredient to more accepted products?
  - “Trickle down” effect – “rich” western/developed nations practices have effect on what people in developing nations pursue – they sometimes want to eat what the “rich countries” eat
  - Less sensational/exotic
  - How this can truly help solve hunger
  - Food safety – demonstrate/emphasize safety aspects to public
  - Food security
  - Slogans?
  - How people accept new ideas:
    - Big jump at first, but then it stops
    - Then some delay followed by another large increase
    - Who are the catalysts? Celebrities?
    - Incentives: health,
    - We should work with social scientists and marketing experts, PR, etc.

- Food choices available to people plays a role?
  - Reasons on which choices are based?
- Devise an image – work on a positive well received image
- Piggyback on other industries/fields related to this synergistically (algae, sustainable energy, etc.)
- Not only to solve hunger – also standard cuisine for developed/western cultures (Asian fusion as a model? Etc.)
- In Niger 75% of people eat insects, in east Africa is different, each country is different, eating insects is increasing – Republic of Central Africa 90% of people eat insects !!!
- In some African countries, it is not a food for the poor because it is more expensive! In the Democratic Republic of Congo
- Insects are more than 60% of all organisms, over 80% of all animals – so it is illogical that we do not use them as food
- Big restaurants (McDonalds etc.) are doing locally adapted menus, so this is an opportunity
- Some cultures actually do want to see the whole insect as they eat it! – Asian, Russian – because they see it as more natural – but do we need to necessarily need to convince these people to eat them, or is our focus others who do not already accept the idea?
- Identify the best tools for different target audiences (Industry, Government, Academia, Science, Research, Education, General Public, - Make it relevant to the audience
  - Industry: identify success stories of insect utilization in food
    - R&D/Strategic sector
    - Awareness
    - Provide robust reasons why this is both viable and important (nutrition for children/babies/pregnant women, etc.)
    - Safety aspect is important
    - Price and Availability
    - How can producers communicate to end user companies so that those companies have a market – or communicate to the public so that market demand can be formed
    - Industry will likely be targeted to specific markets, partly due to current size of production capacity, etc.
  - Consumers:
  - Government:
  - Aquaculture may be a good model
- Internet

## **Towards an international conference on insects as food and feed**

No specific 'recommendations' were produced at this early stage of discussions regarding the possibility for convening an international conference. Participants elaborated a comprehensive list of logistical and technical considerations to think about when planning for such an event.

- Form an organization committee to continue planning the congress after this current meeting.
- Name of the meeting? (World Congress?, Congress or conference?, First World Congress on Insects and Food and Feed ?, First Global Congress on Insects as Food and Feed ?,....
- Insects or Invertebrates? Which term might be best?

- Should be a BROAD program – Academia, Government, Industry, Hobbyists, Organizations, etc.
- Location? (Strategic selection of location).
- Potential groups/audiences of interest:
  - Science societies in all countries (Entomological societies, Ecology, Food science, insect pathology, etc.)
  - Agro ecology
  - Anthropology
  - People and governments in developing countries
  - Food industry
  - Food science
  - Ethnobiology
  - Nutritionists/medical
  - Animal Science
  - Policy makers/politicians
  - Donors/Philanthropists
  - Waste distributors
  - Aid organizations
  - Rural development
  - Academia
  - NGO's (Non Governmental Organizations)
  - Entomology societies
  - Insect producers (for food and feed insects, insectaries, insect zoos, hobbyists, bio control, etc.)
- What are the objectives of the conference?
  - Connect science and industry – stimulating private public partnerships
  - Build awareness of the area and opportunities that exist in this field
  - Trans-disciplinary, interdisciplinary
  - Education and outreach?
  - Creating interest among insect producing companies to look into producing insects as food and feed
  - Evaluate landscape of regulatory and ethics considerations – how to treat the insects, feeding insects to humans, etc.
  - Book: “Do Fish Feel Pain” might have useful info?
  - Do insects experience pain? – very unknown field
  - Sharing of practical experience in areas of interest – insect production, cultural insect use, nutritional properties of insect, health effects, etc.
- Funding?
  - Corporate and agency sponsorship?
  - Grants
  - Vendor exhibit fees
  - Fees to attend congress
- How big should the conference be?
- Can we have a presence of some sort in an existing food fair, or more than one? (outside of the Congress we are planning now)
  - Bug Bowl in Indiana?
  - BugFest in North Carolina
  - Trade shows for food industry
  - Larger fairs for the public trying different foods
  - Aid oriented fairs/events?
  - list other possible venues
- How should the meeting be organized?
  - Parallel sessions?
  - Keynote speakers?

- Social events?
  - Insect eating reception/banquet
  - Opportunity to try insect food products
- Education and outreach?
- Career development – recruitment of employees/students/etc.
- Other society meetings as a model? (Entomological Society of America? Others?)
- Could this be the first meeting of the International Society of Insects as Food and Feed? (more like a science society – which will be formed independent of the industry association and will be more broad)
- Special issues of existing journals in Entomology, Food Science, etc.
  - Journal of Economic Entomology
  - Journal of Sustainable Agriculture
  - Annals of the Entomological Society of America
  - Barbara Cunningham’s journal – at FAO, Rome –
  - Pick one with a good impact factor and broad scope
  - Journal of Tropical Insect Ecology
  - Journal of Ethnobiology
  - PLOS Biology, PLOS One
  - American Entomologist
  - Ecology of Food and Nutrition
- Launch a new journal for the society/topic
- Publish Congress proceedings in the first issue of the new journal
- Meeting proceedings – only abstracts? (Paper form, CD, Post it online)
- Plenary sessions?
  - Too early to say, depends on number of attendees, number of topics/sessions, etc.
- 4-5 days total duration
  - One day in the middle for excursions/trips/tours/etc.
  - 3 days and make people long for another meeting?
- Poster sessions to encourage cross disciplinary discussion?
  - Designated time for poster sessions and interaction in the evenings – nothing else going on this time –
  - In same location as vendor booths for marketing, networking with industry, career development (students to find jobs, etc.)?
- Exhibits, Vendor booths?
  - Some years, the ESA has a 1-day fair at the end of the annual conference for school children, general public
  - Vendor booths at the conference
- Sponsors?
  - Consider incentives for sponsors/exhibitors for their fees: advertising?, using money to bring people from developing countries?
- Special sessions?
- Workshops? Product demonstrations?
- How long will the talks be? 20 minutes? (15 for talk, 5 for questions) Longer for keynote/plenary talks?
  - Organize sub-conferences for target audiences
- Invite keynote speakers from prominent agencies (USDA, etc.)
  - Have a special issue of a journal? – Annals of the Entomological Society? Food science journals?
  - Announce the meeting at other Entomological and food science conferences
  - Contact food science and Entomology societies to gauge interest, get the word out, etc.

- International Entomological Congress in Korea in August 2012 – there will be a session on edible insects, but maybe it has been dropped?

# Summary notes of the working groups

## ***Insect ecology and biology***

It is estimated that 80 percent of the world's population include insects in their diet. In spite of this, there is a dearth of information about the consumption of insects as food—a practice known as entomophagy—around the world. In particular, little is known about which species are eaten, where and to what extent they contribute to food security. Moreover, it is important to note that although the words “edible insects” and “entomophagy” are often used interchangeably, other “mini-livestock” species eaten include not only arthropods like insects, arachnids, crustaceans, diplopods, and centipedes, but also earthworms. An inventory of all edible invertebrate species in the world using taxonomical and ethno-taxonomical classifications is, in turn, not only timely, but necessary to draw attention to a much needed alternative source of protein that, when harvested, can have minimal impact on the world’s natural resources.

## **Harvesting insects and other arthropods from nature: research needs**

In tropical countries most arthropods are collected from the wild. Not much is known about the effect of (over)harvesting on the supply and distribution of target species and on ecosystems. More research is needed on this front, along with the development of sustainable harvesting practices. The biology, ecology and population dynamics of edible insect species and their dependence on the habitat during the year also need to be studied further. Could climate change effect the supply and distribution of edible insect populations? Might habitat be manipulated to enhance the abundance of edible insect populations? These are among the questions that need immediate research attention. It is known, for instance, that sometimes insects are collected as food and feed in an integrated pest management strategy (combining physical control with entomophagy). This is commendable and deserves further exploration. These are just a few of the questions and opportunities that need to be explored to develop insects as viable human food sources.

## **Knowledge gaps**

Whilst relatively new to Western culture, the consumption of edible insects has been common practice in many regions and cultures around the world for hundreds of years. Local knowledge on edible arthropods needs to be documented in order to develop this unique protein source and feed a growing global population. Information is needed on vernacular names, traditional collecting strategies, conservation practices and methods to preserve, process and prepare insects for consumption. Research is also needed on the different roles played by men, women and children in collecting, preserving, marketing and preparing edible insects. At a national level, data is needed on the importance of edible insects in local diets.



Wild harvesting in the Asia Pacific Region. Presentation by Alan Louey Yen.

## ***Farming insects at household level***

In most tropical regions insects as food are harvested from the wild, farming only takes place on a very limited scale. In most temperate zones, insects are reared by companies who sell them as pet-or fish feed.

### **Choice of insects**

When promoting rearing practices in tropical countries, local species should preferably be selected as they pose virtually no risks for the environment and are likely to be more readily accepted. Selection criteria should also involve ease of rearing, taste, colour and the possibility of using them as feed. In temperate zones, cosmopolitan species like the house cricket (*Acheta domesticus*) should be used, or those that are not at risk of quarantine.

### **Material**

In the tropics emphasis should be made on maximizing the productivity of traditional management systems. Procedures for small scale farming should be developed, for instance, a kit for home-use, so people can easily start small-scale rearing facilities. Feed for insects needs to be obtained locally. The possible use of available organic

waste (or rest-streams) for instance should be evaluated as there might be great potential for insect feed.

## **Communication**

Farmers should be given the means to learn from each other's experiences. To this end, the creation of cooperatives should be promoted in both tropical and temperate countries. Workshops for sharing knowledge and to enhance networking should also be organized.

## **Training**

In tropical countries training could be conducted using the 'Farmer Field School' approach, which has proved successful in other agricultural development settings. This requires involving local extension services. Knowledge on insect farming should also be incorporated into formal educational systems including elementary and secondary schools and universities, with the aim of making people aware that insects can be farmed just like other livestock.

## ***Industrial scale mass production***

One ton/day was considered to be a minimum for "industrial mass scale" production (by specifying if weight is *wet* or *dry*).

## **Species and strain collection**

Species better-suited for mass production need to possess certain characteristics, including:

- a high intrinsic rate of increase ( $r_m$ ) (short development cycle, high survival of immatures and high oviposition rate);
- a high potential of biomass increase/day (weight gain/day);
- a high conversion rate (kg biomass gain/kg feedstock)
- the ability to live in high densities (kg biomass/m<sup>2</sup>);
- and low vulnerability to diseases (resistance).

Because of the vulnerability of the production system heavy reliance on a single species is discouraged.

Further considerations to make include:

- 1) Is the species amenable to large scale automation such that labour costs can be reduced?
- 2) Can the species be contained in non-native areas?
- 3) Is there a possibility of genetically improving species by selective breeding to get high quality strains?

Finally, it is recommended to preserve Parental genetic lines in case of culture crashes. Good candidates were considered to be the black soldier fly (*Hermetia illuscens*) and the yellow mealworm (*Tenebrio molitor*).

## **Choice, cost and reliability of feedstock**

First, it is important to determine whether the insects are destined for feed or food. For insects to be used as feed, different (organic waste) side streams can be considered. However, when insects are used for human consumption, the agricultural products need to be feed grade or even food grade when insects are not degutted. It may even be that waste streams should not be considered. Furthermore, the feedstock needs to be cheap (or ideally free of charge), locally available, of consistent quality and supply, and above all free of pesticides and antibiotics.

### **Safety, Health and Environmental issues (SHE)**

Safety is of paramount concern. The mistakes made in the livestock industry should serve as a learning lesson for insect rearers (e.g. the use of antibiotics to control insect diseases). Disease management strategies should aim to be preventive in nature. Human hazards related to production should be circumvented, such as passive vectoring of pathogens and the development of allergies for personnel in the production units. The rearing system design should also minimize sensitivity to diseases. Risk guidelines as well as sanitary standards need to be established and implemented for each species.

### **Strategic issues**

The industry will be judged on whether it can set up a reliable and consistent production chain of high quality and above all produce feed/food with high nutritional value. To achieve this, a series of developments are recommended, including:

- Creating an “International Society of Producers of Insects as Food and Feed” is deemed necessary (to complement the existing Association of Insect Rearers for Biocontrol), and consider a society publication.
- Developing a code of practices/standards (possibly modelled along the lines of the mushroom industry) and product quality metrics to garner credibility.
- Adopting a “common language” by the industry in order to ease communication with the general public.
- Developing a marketing strategy, that establishes which industries and consumers to target.
- Creating a list of species that are “society approved” for use as human food.
- centralizing information, including data, literature, methods, practices, etc. and finally,
- Establish a liaising with policy makers and researchers.
- 

### ***Insects for livestock and fish feed***

Given that regulations to use insects as feed for fish and livestock are less strict than when insects are used as food, the use of waste streams (of organic matter including manure) becomes easier and probably does not need to be refined.

### **Markets**

The urgency to find alternative protein sources for feed has resulted in high market acceptance and market recognition for insects. For fish and poultry, insects are already natural feed. In China silkworm pupae powder is already used as feed. The

costs, reliability of supply and the quality of the insect protein product will determine the market demand. Costs include the possibility of using organic side streams, the labour involved, the yield, investment needed, and the economies of scale. It remains to be considered whether insects as sustainable feed should be marked as organic in order to receive a premium. It may be useful to list all the advantages of using insects as feed compared to the conventional protein ingredients.

### **Important conditions**

When using waste streams the feed safety need to be assured (pathogens, contaminants, heavy metals) and the regulatory conditions must be developed and respected. Quality needs to be high and guaranteed. Therefore, quality control guidelines of insect-based feed should be developed (nutrient composition, pathogen load, etc.). The reliability of insect production must be high as the feed industry needs to be sure that their demands can be fulfilled.

### **Research**

The species need to be carefully selected according to their suitability as feed but also whether they can be mass reared at reasonable costs. Issues that need to be explored further—such as whether problematic feed sources (e.g. toxic *Jatropha* or leftovers from the biofuel industry) can be transformed through insects into suitable animal and fish feed and what the correct processing technologies to turn insects into feed are (e.g. drying, purification) need to be addressed. A multi-disciplinary approach is needed, which also involves engineers.

### **Strategy**

In order to be successful the golden triangle approach is recommended. This entails collaboration between:

- Industry
- Research (both fundamental and applied) using the following approaches:
  - multidisciplinary (between biological sciences, e.g. entomology, nutrition, food technology);
  - interdisciplinary (between biological and social sciences considering for example consumer acceptance);
  - transdisciplinary (involving non-academic partners, such as industry, consumer organizations, NGOs, etc.)
- National and International Regulators and Policy Makers (such as FAO, WHO, EU, EFSA & DG's, FDA & USDA, etc.)

Regulators and policy makers could help by promoting and enabling international collaboration and knowledge exchange, and supporting international Research and Development consortia.

## **Nutrition**

### **Nutritional advantages of edible insects**

Insects are an important source of protein and when gathered from the wild simple to harvest and not requiring feed -- contrary to livestock such as chickens. In some tropical countries where malnutrition is an issue, emphasis should be placed on the regular incorporation of edible insects in the diets in order to improve their nutritional value. Nutritional advantages of insects are probably less important in temperate countries, because malnutrition is not an issue. Moreover, people are not accustomed to eating insects. In these regions, it would be opportune to play on the ecological advantages of insect consumption over conventional meat, and in the long run, the economical benefits.

### **Analysis**

Many studies have been conducted on the nutritional value of edible insects. However, gaps still remain and the results are not consistent. That is partly due to the variation among species, and the differences in feed, season, insect stage, and so on. However, differences in nutritional values of the same insect species are also due to varying methodologies. Screening and analysing nutritional data is very time and labour consuming and requires good cooperation between nutritionists and entomologists. Assessing micronutrient content in insects is also a difficult task. In order to create a solid database, standard analytical methodologies should be developed. Available nutritional data will be included in the FAO database INFOODS.

### **Target group**

Knowledge of the nutritional value of edible insects is necessary to have a clear understanding of how insects can fill dietary gaps in places where malnutrition is an issue. This knowledge can, in turn, be used to counter local nutritional deficiencies. What's more, insects could be used in Ready-to-use therapeutic food (RUTF) such as the "[plumpy'nut](#)" (a peanut based paste for treatment for malnutrition). Industry should have a role in these initiatives.

## ***Insect food processing and trade***

Participants discussed the issue of processing insects for human consumption, including the need for standardization. Processing consists of different stages depending on the species and more research is needed to optimize operations.

### **Standardization**

A defined degree of guaranteed safety is necessary for any product. This needs to be developed for both developing and developed countries. Feasible practices for production (including sanitation measures) need to be developed for which other industries can serve as “role models”. A legal framework must be developed and enforced throughout the entire sector. For international trade, standardization is necessary but difficult because of the diversity of insect species and processing methods. Nevertheless, this dilemma needs to be addressed.

### **Process stages**

Food safety and economic feasibility are important issues for processing. Critical points include how long insects can be kept alive and the duration of the shelf life of the preserved insect product. There is a trade-off between preservation (shelf life) and product quality. Current problems are lack of traceability (track and tracing procedures) and lack of knowledge on separation techniques (protein, fats and chitin).



Freeze dried mealworms and grasshoppers produced by Kreca were available for tasting during the meeting.

### **Cultural preferences**

Culture needs to be factored in to decisions regarding processing. Cultural preference is determined by ethics, religion and tradition, among other things. For example, in Western cultures people will be more willing to consume insects when they are fully transformed, processed, and no longer recognizable. On the contrary, in many other parts of the world insects are considered a delicacy when consumed whole.

## ***Food safety***

Insects should be considered as a common food item or food-ingredient from a food safety perspective. Participants discussed the technical aspects related to food safety and little attention was given to legislation.

## **Hygiene**

Little is known about the gut microbiota in insects. The possible presence of pathogens, viruses and toxins that pose a danger to humans needs to be studied further. The effects of the insects' feed should be taken into account, particularly when these are organic side streams. Differences between producing meat products from traditional animal sources versus insect based products should also be identified. It is generally believed that the insects themselves are inherently safe, however, adequate sanitation needs to be enforced through proper handling and storage techniques (e.g. correct temperature and packaging). Insects sold in local markets as ready-to-eat-products should be held to high hygienic standards to prevent contamination.

## **Processing**

Processing (i.e. making a meal with insects) should both ensure the safety of the product whilst preserving its nutritional value. Preservation methods (e.g. using UV, light, pH, high pressure) should be developed to remove possible contaminants. Careful attention should be paid to frying, as re-use of oil may pose a risk to local market produce.

## **Chemical hazards**

The possible presence of pesticides or heavy metals in insects needs to be verified. Insects with a very short life cycle may have a lower risk of accumulating chemicals.

## **Allergens**

Eating insects might offset allergic reactions in people sensitive to specific proteins, and therefore their allergenicity should be tested.

## ***Communication, consumer attitude, marketing***

In most developing countries there is [FAO representation](#) (some offices serve several countries) which can support the Organization's communication efforts while for developed countries there are liaison offices. FAO deals mainly with [governments](#) (Ministries of Agriculture) and less directly with the private sector or NGOs and this needs to be taken into account in any communication strategy. Additionally, the organization can provide its own funds for studies or field projects ([Technical Cooperation Projects](#)) in member countries for an amount up to US\$ 500.000 per project/country.

### **Communication strategy**

- **End users/consumers.** A relationship needs to be developed with chefs of key restaurants (for example, by sending samples of products), zoos, museums, schools and farmer associations. Market-savvy language needs to be used coupled with credible information. The environmental benefits of the product also need to be played up.
- **General public.** The approach needs to cater to the specific demands of developing and developed countries. For example, in developing countries the nutritional benefits for children and pregnant women can be stressed, while for developed countries the delicacy aspects can be emphasized. It is important, moreover, to liaise with schools through teachers. Consumers' demands need to be taken into consideration.
- **Policy makers.** A "selling point" with policy makers will be the sustainability of the product alongside its minimal ecological footprint.
- **Media.** In the western world the rationale behind eating insects should be stressed and its sensational aspect played down. Celebrities and high profile chefs should be involved in promoting insects as an alternative protein source, through mainstream media outlets and educational programmes. Traditional and new media can also be engaged (e.g. Television via children's movies and list servers, such as a "Entomo-L list-server", similar to Ecolog-L).

The communication strategy needs to be comprehensive and has to target region, culture, locality (rural, urban), and tradition. In developing countries, different approaches should be used for urban, sub-urban, and rural communities (rural communities often follow the example of urban communities). Similarly, in developed countries, a selling point could be sustainability. Careful research needs to be undertaken in regards to popularizing the product, should the health or environmental aspects be stressed? Should taste or fashion be played up? It is hoped that if developed countries begin to seriously consider entomophagy, it may trigger a change in attitudes in developing countries, where western lifestyles are often emulated.

More research is also needed to understand whether the use of the word "insect" is strategically wise from a communications standpoint. Alternatively, "insect meat" may be used; however, this would not be entirely correct because more than the meat of insects is eaten. When considering names several factors need to be taken into account: country of origin/market, type of insect, and final product (the word "land shrimp" was used by Marco Polo when he went to China and ate grasshoppers).

## ***Food and feed policies and Food Security (focus on policy)***

To push insects for food and feed higher on the agenda of governments and other public organizations awareness-raising campaigns need to be well-targeted. Governments should be supported in amending existing feed and food policies and creating new ones. Research and development institutions also need to be pro-active and contribute to self-regulation in the sector in order to enhance implementation by governments.

### **Targeted awareness**

Targeted awareness should be created at the local, national and international level by different stakeholders: consumers, scientists and convinced policy makers. Awareness can be raised by linking the opportunities of using edible insects with existing projects and programmes such as FAO's [Save & Grow](#), and integrating the issue in curricula of relevant faculties of universities. Personal relations can also enhance recognition and support from high level organizations, which can raise attention in their programs, meetings or projects.

### **Implementation strategy**

Scientists, industries and regulators need to collaborate pro-actively and contribute to self-regulation in the sector. An analysis of existing policies and regulations on food ([Codex Alimentarius](#)) and feed ingredients ([European Directives about animal feed](#)) is necessary and can be achieved by:

- Communicating with the relevant regulatory bodies and their key contact persons;
- Identifying impediments and finding out where the existing framework needs to be improved.

Developing new policies will be inevitable. It will be necessary to listen to regulators to find out what can be expected, to be sensitive to consumers who might demand specific regulations, and to collaborate with retailers (cfr. [Global GAP](#)). Examples of new regulations to be considered are: quality standards, quality control and quality assurance guidelines on contaminants and nutritional compositions, label requirements, environmental impact assessments, requirements for feed for feeding animals (for example can manure be used?), etc.

# Annex

## A. Agenda

Monday 23 January: Opening of the Technical Consultation meeting and start of the presentations and technical discussions

<p><b>9.30-10.00</b></p> <p>2<sup>nd</sup> Floor, Building D, Lebanon room (D209)</p>	<p><b>Opening and welcome speeches</b></p> <p>Food and Agriculture Organization, Forestry Department, <i>Mr Eduardo Rojas-Briales, Assistant Director General</i></p> <p>Ministry of Foreign Affairs, The Netherlands, <i>Ms Eva van Woersem, alternate Permanent Representative to the UN Organizations</i></p>
<p><b>10.00-10.45</b></p> <p>2<sup>nd</sup> Floor, Building D, Lebanon room (D209)</p>	<p>The importance of insects as food and feed, <i>Prof. Arnold van Huis, Wageningen University.</i></p> <p>Objectives, output and proceedings of the meeting, <i>Paul Vantomme, Senior Forestry Officer, FAO, Forestry Department.</i></p>
<p><b>10.45-11.15</b></p>	<p><b>Coffee Break</b></p>
<p><b>11.15-12.35</b></p> <p>2<sup>nd</sup> Floor, Building D, Lebanon room (D209)</p>	<p><b>Plenary presentations I : Insect ecology and biology by region</b></p> <ol style="list-style-type: none"> <li>1. Edible insect issues in the Asia Pacific Region / <i>Prof. Louey Yen Alan, La Trobe University</i></li> <li>2. Brazil / <i>Prof. Eraldo Meideros Costa Neto, University of Feira de Santana</i></li> <li>3. Africa / <i>Prof. Séverin Tchiboza, Centre de Recherche pour la Gestion de la Biodiversité</i></li> </ol> <p><b>Plenary presentations II: Farming aspects</b></p> <ol style="list-style-type: none"> <li>1. Farming insects in developed countries (NL) / <i>Margot Calis, Farmer VENIK</i></li> </ol>
<p><b>12.35-13.35</b></p> <p>Cafeteria, 8<sup>th</sup> Floor</p>	<p><b>Lunch</b></p>
<p><b>13.35-14.55</b></p> <p>2<sup>nd</sup> Floor, Building D, Lebanon room (D209)</p>	<p>Continued</p> <ol style="list-style-type: none"> <li>2. Edible insect farming in Thailand / <i>Prof. Yupa Hanboonsong, Khon Kaen University</i></li> </ol> <p><b>Plenary presentations III : Industrial scale mass production</b></p> <ol style="list-style-type: none"> <li>1. Insect as feed (<i>mass production/organic side streams</i>) / <i>Santos Rojo, University of Alicante</i></li> <li>2. Industrial Mass Production of Insects – Considerations and Logistics / <i>Mr Ernie Papadoyianis, Director Organic Nutrition</i></li> <li>3. Food Waste / <i>Robert Van Otterdijk, Agro-Industry Officer,</i></li> </ol>

	<i>FAO, Agriculture and Consumer Protection Department</i>		
	<b>Coffee break</b> (during the session)		
<b>15.00-16.30</b>  WG 1: 2 <sup>nd</sup> Floor, Building D, Lebanon room (D209)  WG 2: 2 <sup>nd</sup> Floor, Building B, Cuba Room (B224)  WG 3: 3 <sup>th</sup> Floor, Building A, India Room (A327)	<b>WORKGROUP 1</b>  Insect ecology and biology	<b>WORKGROUP 2</b>  Farming insects at the household level	<b>WORKGROUP 3</b>  Industrial scale mass production
<b>16.30-17.30</b>  2 <sup>nd</sup> Floor, Building D, Lebanon room (D209)	<b>Plenary WG outputs presentation &amp; discussions</b> (20 minutes each group)		
<b>17.30-18.00</b>	<b>Summary of the day for input into Position Paper and outline of day 2</b>		
<b>18.30-20.00</b>  Indonesia room, 8 <sup>th</sup> Floor	<b>Opening cocktail event</b>		

Tuesday 24 January: Continuation of Technical discussions for input into Position paper

<b>8.30-8.40</b>  2 <sup>nd</sup> Floor, Building D, Lebanon room (D209)	<b>Opening and outline of the day</b>		
<b>8.40-9.50</b>  2 <sup>nd</sup> Floor, Building D, Lebanon room (D209)	<b>Plenary presentations IV : Nutrition, food processing and trade aspects</b> <ol style="list-style-type: none"> <li>1. Quest for novel livestock feeds / <i>Harinder Makkar, Animal Production Officer, FAO, Agriculture and Consumer Protection Department</i></li> <li>2. FAO Agriculture and consumer protection, nutrition / <i>Diedelinde Persijn and Ruth Charrondiere, Nutrition officer, FAO, Agriculture and Consumer Protection Department</i></li> <li>3. Nutrition and food safety of edible insects / <i>Prof. Nanna Roos, University of Copenhagen</i></li> <li>4. Processing and Trade / <i>Antoine Hubert, Director Ynsect</i></li> </ol>		
	<b>Coffee break</b> (during the session)		
<b>10.00-11.20</b>  WG 1: 2 <sup>nd</sup> Floor, Building D, Lebanon room (D209)  WG 2: 2 <sup>nd</sup> Floor, Building	<b>WORKGROUP 1</b>  Insects for livestock and fish feed	<b>WORKGROUP 2</b>  Nutrition	<b>WORKGROUP 3</b>  Insect food processing and trade

B, Cuba Room (B224) WG 3: 3th Floor, Building A, India Room (A327)			
<b>11.30-12.30</b> 2 <sup>nd</sup> Floor, Building D, Lebanon room (D209)	<b>Feedback to Plenary of WGs outputs</b> (20 minutes for each group)		
<b>12.30-13.30</b> Cafeteria, 8 <sup>th</sup> Floor	<b>Lunch</b>		
<b>13.30-14.50</b> 2 <sup>nd</sup> Floor, Building D, Lebanon room (D209)	<b>Plenary presentations V: Food safety and communication</b> <ol style="list-style-type: none"> <li>1. Codex Alimentarius / Tom Heilandt, Senior Food Standards Officer, FAO, <i>Agriculture and Consumer Protection Department</i></li> <li>2. Food/feed safety considerations / Tilemachos Goumperis, <i>Emerging risk unit, EFSA</i></li> <li>3. Communication, Attitudes, Intercultural Competency / Prof. Florence Dunkel, <i>University of Wisconsin - Madison</i></li> <li>4. Assuring Food Security: what does it mean? / Mark Smulders, <i>Senior Economist, FAO, Economic and Social Development Department</i></li> </ol>		
	<b>Coffee break</b> (during session)		
<b>15.00-16.25</b> WG 1: 2 <sup>nd</sup> Floor, Building D, Lebanon room (D209) WG 2: 2 <sup>nd</sup> Floor, Building B, Cuba Room (B224) WG 3: 3th Floor, Building A, India Room (A327)	<b>WORKGROUP 1</b> Food safety	<b>WORKGROUP 2</b> Communication, consumer attitude, marketing	<b>WORKGROUP 3</b> Food and feed policies and food security
<b>16.30-17.30</b> 2 <sup>nd</sup> Floor, Building D, Lebanon room (D209)	<b>Plenary: presentation and discussions on WG outputs</b> (20 minutes for each group)		
<b>17.30-18.00</b>	<b>Summary of technical inputs for Position Paper</b> (output 1) <b>and outline of day 3</b>		

Wednesday 25 January: Elaboration of the Action Plan, final conclusions and closure

<p><b>08.30-08.40</b></p> <p>2<sup>nd</sup> Floor, Building D, Lebanon room (D209)</p>	<p><b>Opening and outline of the day</b></p>		
<p><b>08.45-10.25</b></p> <p>WG 1: 2<sup>nd</sup> Floor, Building D, Lebanon room (D209)</p> <p>WG 2: 2<sup>nd</sup> Floor, Building B, Cuba Room (B224)</p> <p>WG 3: 3<sup>th</sup> Floor, Building A, India Room (A327)</p>	<p><b>WORKGROUP 1</b></p> <p><b>Strategy and action Plan:</b> <u>private sector</u></p>	<p><b>WORKGROUP 2</b></p> <p><b>Strategy and action Plan:</b> <u>public sector</u></p>	<p><b>WORKGROUP 3</b></p> <p><i>Towards an International Conference on Insects as food and feed</i></p>
<p><b>Coffee Break</b> (during session)</p>			
<p><b>10.30-11.30</b></p> <p>2<sup>nd</sup> Floor, Building D, Lebanon room (D209)</p>	<p><b>Feedback of WG outputs to plenary</b> (20 minutes for each group)</p>		
<p><b>11.35-13.00</b></p> <p>WG 1: 2<sup>nd</sup> Floor, Building D, Lebanon room (D209)</p> <p>WG 2: 2<sup>nd</sup> Floor, Building B, Cuba Room (B224)</p> <p>WG 3: 3<sup>th</sup> Floor, Building A, India Room (A327)</p>	<p><b>WORKGROUP 1</b></p> <p><b>Strategy and action Plan:</b> <u>FAO</u></p>	<p><b>WORKGROUP 2</b></p> <p>Communication strategy (governments, international agencies, private sector, databases, networking, etc.)</p>	<p><b>WORKGROUP 3</b></p> <p><i>Towards an International Conference on Insects as food and feed</i></p>
<p><b>13.00-14.00</b></p> <p>Cafeteria 8<sup>th</sup> Floor</p>	<p><b>Lunch</b></p>		
<p><b>14.00-15.00</b></p> <p>2<sup>nd</sup> Floor, Building D, Lebanon room (D209)</p>	<p><b>Feedback of WG outputs to plenary</b> (20 minutes for each group)</p>		
<p>15.00-16.00</p>	<p><b>Plenary: draft Action Plan finalized</b> (output 2)</p>		
<p><b>Coffee Break</b> (during session)</p>			
<p>16.30-17.00</p>	<p><b>Final conclusions and closure of the meeting</b></p>		

## B. List of participants

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