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**Regulating edible insects: the challenge of addressing food security, nature conservation, and the erosion of traditional food culture**

A. Halloran<sup>1</sup> & P. Vantomme<sup>2</sup> & Y. Hanboonsong<sup>3</sup> & S. Ekesi<sup>4</sup>

Abstract Entomophagy is a common practice in many regions of the world but there are few examples of national regulations that govern insects for human consumption. Where entomophagy is not common, the current regulatory discourse focuses primarily on food safety and consumer protection. In countries where insects contribute to local diets, nature conservation is often an issue of high importance. This paper investigates the variation in the ways in which entomophagy and its related activities are currently regulated in Thailand, Switzerland, Kenya and Canada. Authoritative bodies who are responsible and the roles they play are discussed. Insects have only recently entered into the sustainable food dialogue, but have not yet been incorporated into policy documents and have been largely omitted from regulatory frameworks. Moreover, even in nations where there is a tradition of consuming a variety of insect species, they do not appear explicitly in dietary guidelines. Although food safety is a major concern, it can undermine the importance of nature conservation, traditional food culture, food security, and potential economic development. Thus, entomophagy should be viewed holistically and development of future legislation must take into consideration its multi-dimensional nature.

Keywords: Entomophagy / Regulatory frameworks / Food security / Food safety / Nature conservation / Traditional diets

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## Introduction

In May 2014, the Food and Agriculture Organization (FAO) of the United Nations and Wageningen University and Research jointly hosted the Insects to Feed the World Conference in Ede, The Netherlands. Approximately 450 participants gathered from more than 45 countries to discuss issues related to insects as food and feed. The conference summary concluded that the “major challenges include... : further awareness-raising among the general public to promote insects as healthy food for humans and feed for animals; influencing policy makers to approve insect inclusive food and feed legislations; and further research efforts to provide and expand with validated data the available scientific evidence and benefits of using insects in the food and feed chains” (FAO/WUR 2014). Unsurprisingly, the issue of insect inclusive food and feed legislation featured in the vast majority of the presentations as an unresolved issue.

As noted by Halloran and Münke (2014), the greatest barriers to the growth of an edible insect sector is the lack of all-inclusive legislation that governs the production, use and trade of insects as both food and animal feed. Although the discourse regarding the regulatory frameworks influencing insects as food and feed has gained momentum in the past couple of years, it is not new. For example, at the national level, research regarding the need for the recognition of insects as a food resource in Mexico has been extensively discussed by Ramos-Elorduy and Paoletti (2005). The willingness of some decision making bodies, such as the Directorate-General of Health and Consumers (SANCO) of the European Commission, to discuss the possibilities for incorporating insects into food and feed legislation has gradually increased. A case in point is that of Laos PDR which proposed a regional food standard for insects in 2010 under the Proposal for new work on development of regional standards for edible crickets and their products. This proposal was supported by the neighbouring countries of Cambodia, Thailand and Malaysia (FAO 2010). National governments, such as the Netherlands, are actively funding researchers investigating issues of legislation for governing insect farms, health and safety standards, and marketing through retail outlets (Pascucci and Magistris 2013).

This paper reviews various actions taken or underway in Thailand, Canada, Kenya and Switzerland in order to address and understand the relevant stakeholders and multi-jurisdictional regulations and legislations governing the use of insects as food and feed. It builds on an earlier draft by FAO “Discussion paper: regulatory frameworks influencing insects as food and feed” (Halloran and Münke 2014) and assesses regulatory frameworks including legislation, standards and other regulatory instruments which are legally binding or otherwise in the use of insects as food and feed.

### Thailand

Thailand boasts a large and successful commercial insect sector that produces primarily for human consumption. Locusts, crickets, giant water bugs, bamboo caterpillars, beetles, palm weevil larvae and ants are the most commonly consumed and marketed in the country and beyond. These species are either wild harvested, semi-cultivated or farmed (Hanboonsong et al. 2013).

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Among the various insects, cricket farming is the most advanced. The technology was developed by Kohn Kaen University 15 years ago, and then promoted by the Thai government through a small and micro-community enterprise scheme. Despite the fact that there are over 20,000 operating cricket farms with average production of 7500 tonnes per year, research on commercial production is sparse. Moreover, few production and management standards for cricket farming exist, such as hygiene for minimizing disease outbreaks. In many cases, best practices in breeding, nutrition, or pest control are not well understood by farmers (Hanboonsong et al. 2013).

The Ministry of Public Health is the main authoritative body currently regulating insect production and consumption in Thailand. All products processed from insects that are sold in the local markets and exported have to be passed by law through the Food and Drug Administration (FDA) under the Ministry of Public Health. Insect producers have to apply for a licence, and an inspector from the FDA monitors the production site, and also samples and monitors products for proper hygiene standards on a regular basis.

No specific standards for insects as food exist; thus, they are treated like any other food product under the Food Act of B.E.2522 (1979) (Food and Drug Administration Thailand 2014). This is probably attributed to the fact that Thailand, as well as the greater region of South-eastern Asia has a long history of entomophagy and paradoxically has not developed specific food standards to protect consumer safety. Discussions are now underway on how to make the farm GAP (Good Agriculture Practice) index for cricket farming. This should provide some guideline for farmers to follow at farm sites. However, there is little support from extension services to improve techniques and farming conditions (Hanboonsong et al. 2013).

Many of the insects consumed in Thailand are wild harvested. Environmental and habitat changes have caused their decline. The Royal Forest Department under the Ministry of Natural Resources has played a major role in protecting many insect species. However, Thailand, like many other countries, has struggled to conserve wild insect populations despite the availability of legal regulations for species protection that have been put in place by the government (Boongird 2010). For example, there are four official acts for forest conservation and protection which relate to wild bees (Boongird 2010). Due to declining numbers of palm trees, improved techniques for palm weevil semi-cultivation have been developed. The Department has also developed techniques for semi-cultivating bamboo caterpillars in order to ensure a more sustainable caterpillar harvest (Hanboonsong et al. 2013). Despite ministerial involvement, the insect food industry has been largely overlooked by government in relation to other agri-food industries.

As mentioned by Fellows (2014), the widespread use of E-commerce through internet access has allowed producers in Thailand to easily gain access to high value markets in industrialized countries. Products like dried and flavoured crickets have been exported to Europe (mainly France and Belgium) and even the United States. With the expansion of training and education in computing and information technology in many universities in developing countries, Fellows (2014) predicts that an increased amount of insect products will be available to international markets via internet sales. All insect exports from Thailand must be certified by the Royal Forest Department to ensure that no species listed under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) are being traded.

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## Switzerland

Switzerland is an example of a country that has been quick to address requests from its citizens to incorporate insects as food into national legislation. The Federal Department of Home Affairs Ordinance on foodstuffs of animal origin governs animal-derived food products. However, the Ordinance (Article 2) does not recognize insects as an animal species accepted for food production. In 2013, there was active involvement from civil society, namely the organization Grimiam, in placing insects for both food and feed on the agenda.

On 25 November 2013, Councillor Isabelle Chevalley posed an interpellation (Nr. 13.4013) to the Federal Assembly by asking: *Pourquoi interdire la consommation d'insectes?* (Why forbid the consumption of insects?). The interpellation challenged the Federal Council on the following points (Federal Assembly of the Swiss Parliament 2014a):

1. Is the Federal Assembly prepared to propose to Parliament a legislative amendment to allow the consumption of insects?
2. How can the prohibition of eating insects be justified since hundreds of millions of people have consumed insects for millennia (Aristotle praised the exquisite taste of cicada nymphs)?

These interpellations were welcomed by members of the Federal Assembly, as solutions for sustainable food is an area of interest and priority. The Assembly reported back on 12 February 2014 and addressed the following issues (original text in French) (Federal Assembly of the Swiss Parliament 2014a):

1. Insect consumption in Switzerland is not prohibited and consumers can consume insects they breed or collect in the wild themselves. However, selling and serving insects as food is prohibited as insects have not been described in the food and commodities regulation (LGV, SR 817.02);
2. Reliable scientific data on the risk of allergies and the transmission of disease is needed in order to amend the current legislation;
3. The handling of non-native invertebrates in closed systems and free-range trials is regulated for the sake of environmental protection and biodiversity. However, no standardized methods of breeding and production of insects for food have been created to date.
4. While the rearing of selected insect species could contribute to sustainable food and animal feed production in Switzerland many of the fundamental questions remain unanswered.
5. The consumption of specified insects could contribute to sustainable food production, including as an ingredient for animal feed. However, many fundamental questions currently remain and will need answering in order to come to a final decision.

Following this rebuttal two additional interpellations were made on 21 March 2014: 1) Interpellation Nr. 3273 - *Pourquoi interdire en Suisse la commercialisation d'insectes qui sont consommés couramment dans*

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d'autres pays? (Why forbid in Switzerland the commercialization of insects that are widely consumed in other countries?) (Federal Assembly of the Swiss Parliament 2014b), and 2) Interpellation Nr. 14.3274 - Pourquoi interdire l'alimentation des poissons, des volailles et des porcs par des insectes? (Why forbid the feeding of fish, poultry and pigs with insects?) (Federal Assembly of the Swiss Parliament 2014c). These interpellations were supported by 63 and 68 of 200 councillors, respectively.

The Assembly responded to each of the latter interpellations. In particular, the council noted that insects represent an untapped animal feed source for Switzerland. Switzerland is participating in discussions at the European Union level so as to avoid the negative consequences in case insects are not approved in the European Union. Moreover, the use of insects as feed should be accelerated, pending risk analysis (Federal Assembly of the Swiss Parliament 2014c). In terms of insects that are utilized for human consumption, the Assembly acknowledged that there is a growing evidence base supporting entomophagy. Nonetheless, strict regulations and further evidence would need to be generated in order to protect consumer health and safety. Moreover, selected insect species that are fit for human consumption would need to be pinpointed (Federal Assembly of the Swiss Parliament 2014b). A round-table discussion of the Swiss Parliament concerning insects as foodstuff will be inaugurated in the first quarter of 2015 (J. Vogel, personal communication, 6 October, 2014).

## Kenya

In Kenya, the national food safety and quality system is managed by various statutory government agencies operating from different ministries with the broad objective of promoting public health, and protecting consumers against health hazards while enhancing economic development (FAO/WHO 2005; GAIN 2005). Although the country lacks a defined and published policy on food safety as part of a wider National Food and Nutrition Policy, food laws exist that are designed to protect the consumers. Food safety control agencies operate under the Ministries of (1) Trade, (2) Industrialization, (3) Public Health and Sanitation, and (4) Livestock, Fisheries Development, and Agriculture. A summary of the legal and policy framework of these agencies and the implementing mechanisms for the laws is documented by FAO/WHO (FAO/WHO 2005). The agencies include Kenya Bureau of Standards (KEBS), Kenya Agricultural Research Institute (KARI), Kenya Plant Health Inspectorate Services (KEPHIS), Department of Public Health (DPH), Weights and Measures Department (WMD), Government Chemist's Department, Department of Veterinary Services (DVS), Kenya Dairy Board (KDB), and Horticultural Crops Development Authority (HCDA), among others (GAIN 2005; Mwangi et al. 2009). The functions of these agencies include sensitization and implementation of codes of hygiene and agricultural practices by stakeholders throughout the food chain. Standards for food and agricultural products are developed by technical committees, with their secretariats at KEBS. Food standards give specifications for the compositional requirements, microbial requirements, the tolerance limits for contaminants, packaging, labeling and the hygiene conditions necessary for manufacture of products. While there are specific standards for various food and feed items, there are no specific standard for use of insects as food and feed. Rather insects are considered as impurities or contaminants in food that have to be eliminated. The majority of the Kenyan standards are adopted from international ones, International Organization for Standardization (ISO) and Codex Alimentarius Commission – Codex (CAC),

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following the philosophy of the World Trade Organization (WTO) Sanitary and Phytosanitary Standards (SPS) and Technical Barrier to Trade (TBT) agreements (World Bank 2005). There is now support for standards dealing with the use of insects as food and feed and consultations are currently underway with Kenya Bureau of Standards (KEBS) and other relevant agencies to establish a technical committee to draft standards that will govern the application of insects as food and feed.

Kenya Bureau of Standards (KEBS) coordinates all activities concerning the development and implementation of both local and international standards relevant to Kenya (KEBS 2014). Kenya Bureau of Standards is a statutory Public body under the Ministry of Industrialization, operational since July 1974, and mandated by the Standards Act Chapter 496 (NCST 2009). The KEBS board of directors, the National Standards Council, is its policy-making body for supervising and controlling the administration and financial management. To improve on efficiency and provide more effective services to clients, KEBS established a Certification Unit (CU), accredited by the Quality Systems Accreditation Committee (QSAC) that offers certification services. Kenya Bureau of Standards gathers information on quality concerns through industrial visits and receives private complaint samples for analysis in its laboratories as part of quality assurance and testing services components of its operations. KEBS is also the National Codex Contact Point serving as the secretariat of the National Codex Committee (NCC). As the Codex Contact Point, KEBS acts as a link between the Codex Secretariat and Kenya.

In addition to the establishment of standards through KEBS, the main nature conservation authority (i.e., Kenya Wildlife Services), also requires permits for large-scale farming of insects especially crickets. These permits are required in order to: 1) conform to wildlife domestication regulation process; and 2) match regulations on transporting livestock. This is required when moving animals from one zone to another and also includes an approved method of transportation. A zone is a jurisdictional area (part of a district).

The Kenya National Guidelines on Nutrition and HIV/AIDS recognizes entomophagy as a part of traditional food culture, and states that “common sources of animal proteins in Kenya include milk and milk products, beef, poultry, chicken, eggs, fillet, dried small fish (*Rastrineobola argentea*) and edible insects such as termites” (Republic of Kenya 2006; p. 11). Moreover, it recommends that food security in HIV-affected households could be addressed in rural areas by promoting traditional practices of harvesting, preserving and consuming indigenous foods such as edible insects like termites. It is especially recommended when planning for the lean season (Republic of Kenya 2006).

Indigenous foods are allowed for consumption, but not allowed for trade unless registered under the National Bureau of Standards.

## Canada

Food and food safety regulation in Canada occurs at federal, provincial and municipal levels. In general, the federal government deals with laws on food pertaining to import and export, novel foods, and interprovincial transport of food. The provincial levels deal with farming and food processing regulation. The municipal level mainly enforces the provincial laws, and also has a few bylaws pertaining to public

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health. They also work closely with the types of enterprises commonly found in cities and towns (like restaurants, markets, grocery stores etc.) (A. Jean, personal communication, 1 Dec 2014).

Health Canada is the key administrative body in Canada that is responsible for regulations governing the use of insects as food and feed. The Canadian Food Inspection Agency (CFIA) falls under Health Canada and handles issues related to food safety and public health. The CFIA conducts novel food safety assessments under the Food Directorate. The purpose of the directorate is to establish policies, set standards and provide advice and information on the safety and nutritional value of food (A. Jean, personal communication, 1 Dec 2013).

According to the Government of Canada “since the CFIA’s inception in 1997, Canada’s demographic make-up has been changing at a fast pace. With immigration continuing to increase and accounting for a large percentage of the country’s population, the Agency has found itself facing demands for a larger variety of ethnic and imported foods from an ever increasing number of countries, especially developing countries. This demand, coupled with increasing globalization, has meant that the Agency has had to change and evolve at a fast pace to keep up with consumer’s needs” (Government of Canada 2009).

Most of the popular insects used as food around the world do have a history of safe use for human consumption as it is estimated that over 2,000 species of insects are consumed in 80 % of the world’s nations (van Huis et al. 2013). Insects that do not have a history of safe use as food may be considered as novel food and, as such, they may need an assessment from the Novel Food Section of the Bureau of Microbial Hazards, Food Directorate, Health Canada. Insects that are not considered as “novel food” may be offered for sale to Canadian consumers as long as they are not in violation of the Food and Drugs Act and Regulations; namely Sections 4, 5 and 7 of the Act and Division 28 of the Regulations. Division 28 of the Food and Drug Regulations applies to Novel Foods, their assessment and their pre-market notification. This process is similar in nature to EU Novel Food legislation (A. Jean, personal communication, 1 Dec 2013).

Canada is one of the most culturally and ethnically diverse countries in the world. It experiences food culture through the exchange of traditions and world cuisines that are adopted as mainstream trends. Ethnic foods are in high demand and readily available at grocery stores and restaurants (Swiss Business Hub Canada 2011). This could partially explain the general legislative stance and attitude that has been seen in Canada by accepting the contribution of entomophagy to human diets worldwide.

Some restaurants across Canada already serve insects on their menus (Gordon 2011). Restaurants may be allowed to sell dishes containing insects so long as the insects used in the dishes meet the Food and Drugs act regulations. However, municipal or provincial health authorities may have provisions in their own regulations that would condition, limit or prohibit the sale of dishes containing insects (A. Jean, personal communication, 1 Dec 2013).

## Discussion

### Nature conservation

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Conservation policy can often fail to integrate biological and cultural conservation (Correal et al. 2009). In many societies, insects are not only considered as food or feed but also medicine and spiritual symbols (van Huis et al. 2013). Giving an example from the African continent, De Prins (2014) notes in her review of *Edible insects: future prospects for food and feed security* that “there is a conflict of interest between those who protect the tropical biodiversity and those who have the ingenuous wish to improve the agricultural economy in Africa” (De Prins 2014; pg. 1). Therefore, the conservation of insects collected from the wild must also be included when developing legal frameworks.

Thailand represents a country where insects as food are being regulated to a certain extent as a response to a growing number of enterprises commercially exploiting the increasing demand for them. However, since the demand for some insect species in Thailand is so huge that it cannot be met by domestic production, an additional supply of insects is received from neighbouring countries such as Lao PDR (Hanboonsong et al. 2013), which may enforce nature conservation laws less rigorously.

While the examples of Thailand and Kenya demonstrate that satisfying the interests of diverse stakeholders may be a difficult undertaking, such an issue can be tackled. In the West, many national and local governments have governed the collection of wild foods such as mushrooms and game and the same could be undertaken for insects. In order to encourage food security and sustainable diets, regulation of wild harvesting, as well as semi-domestication of farmed insects has been promoted, as is typical for Thailand.

The Swiss Federal Assembly has addressed the issue of nature conservation by regulating non-native invertebrates from being handled in closed systems (Einschliessungsverordnung vom 9. Mai 2012; SR 814.912), as well as in free-range trials for research purposes (Freisetzungsverordnung vom 10. September 2008; SR 814.911). However, there has been no standardization in terms of rearing and production of insects for food purposes to date.

### **Formalization of local economy**

As seen in Kenya and Thailand there is a lack of a legal framework governing insects as food. However, this has proved not to be a major barrier to the expansion of the insect food sector. Insects as food have always been a part of the informal economy in those countries where entomophagy is a common practice. However, where entomophagy has not been a component of food culture, as in many western countries, their respective governments did not have the foresight to predict the future need to incorporate insects into legislation. Because of this, there is often little governance of this resource.

In many countries, the collection, farming, processing and marketing of insects is primarily an informal activity. For example, in Kenya, the majority of the insect species that are consumed including termites, crickets, grasshoppers, lake flies and bees are collected from the wild. However, most recently, attempts are being made to rear these insects by developing simple technologies to assure year round availability and transferring these technologies to smallholder producers. In the process of scaling up, issues such as nature conservation, trade, and food safety will have to be addressed and formalization of rules and regulations governing the use of insect as food and feed will become increasingly crucial.

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Formalization through regulation can threaten local, informal economy. On the other hand, informal economy provides employment and income, especially in areas of high unemployment. As noted by Nelson and Bruijn “informality offers opportunities of economic necessity to the poor, most of who will never be able to assimilate the costs of formalization, and partly because it offers others a low cost arena for experimentation that can lead to business growth” (Nelson and De Bruijn 2005; pg. 579). Nonetheless, the informal sector is not homogeneous and formalization can in many cases provide positive outcomes, such as access to international trade as in the cases of Kenya and Thailand. Further, in order for insects as food and feed to develop, governmental involvement is essential in order to develop appropriate legislation to govern the sector.

In Kenya and Thailand care should be taken to ensure that local populations can continue to consume their traditional foods without disrupting the food system due to an increasing demand from export markets and rising prices. An example of this complicated dynamic is given by how the booming export market for quinoa from Southern Bolivia has impacted the environment and home consumption (Jacobsen 2011; Winkel et al. 2012).

### **Food-based dietary guidelines and food safety**

The World Health Organization (WHO) and the FAO have been responsible for the review of new research and information concerning diets worldwide. Due to the dynamic nature of diets, having a single snapshot of nutrient requirements and recommended nutrient intakes in a given region is an ongoing task. Such nutrients include protein, energy, carbohydrates, fats and lipids, a range of vitamins, and minerals and trace elements.

Many countries are dependent on WHO and FAO to provide them with the necessary information, which is often adopted as national dietary guidelines or used as a basis for their own standards. In 1986, Gussow and Clancy, when discussing dietary guidelines for sustainability in the United States, noted that “the human race once enjoyed a diet drawn from a large variety of plant and animal (including insects!) life. Now the world’s population depends on a mere handful of species...” A number of studies have shown the importance of insects in the diets of a variety of ethnic groups (van Huis et al. 2013; Christensen et al. 2006); however, the inclusion of insects as food is missing from most national food-based dietary guidelines. For example, termites, crickets and locusts are recognized under the “miscellaneous” food group in the Tanzania Food-based Dietary Guidelines (Lukmanji et al. 2008). However, insects are acknowledged in policy documents, such as the aforementioned Kenya National Guidelines on Nutrition and HIV/AIDS and Uganda Food and Nutrition Policy. Insects are not included in the Canada Food Guide or in the Swiss Food-based Dietary Guidelines. The inclusion of locally consumed insect species may help to valorise the contribution of insects to regional or national diets.

In terms of food safety, Switzerland has taken a precautionary approach to addressing insects as food due to the lack of knowledge of their potentially adverse health effects and standardization of rearing methods. Kenyan legislation is comparable to that of Switzerland when it comes to the precautionary approach. Canada, on the other hand, addresses food safety issues in terms of the sanitary standards of the

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establishments handling food products. Therefore, insects are treated like most other food products. Thailand has a similar approach. The involvement of FAO in promoting insects as food and feed sources will be crucial in projecting and harmonizing dietary guidelines for insects in consultation with national systems.

### **Insects as a component of sustainable food policy**

There is broad scientific agreement that food systems are both the cause and solution to environmental problems. However, nutrition and sustainability is an emerging discourse in the food policy arena (Lang and Barling 2013). Insects have been highlighted in a number of high-level international conferences, such as “the International Conference on Forests for Food Security and Nutrition at the FAO, Rome May 15–17”, 2013 as an important pathway to ensuring food and feed security.

Of the recorded 2000+ edible insect species (Jongema 2014), few scattered studies have analysed the nutritional value of insects (van Huis et al. 2013). However, as demonstrated by Rumpold and Schlüter (2013) insects can provide satisfactory energy, protein, amino acids, monounsaturated and/or polyunsaturated fatty acids, and micronutrients.<sup>1</sup> An effective system of legislation, food safety and agricultural health controls must be judged on its effectiveness and scientific and technical relevance. There is the need for continuous dialogue to inform policy on the use of insects as food and feed. Sufficient political will and socioeconomic priorities will be crucial for the introduction and maintenance of regulations for domestic consumption, trade promotion and the welfare of producers and consumers. Safe and high-quality insect products must result from efficient regulation at all stages of the supply chain in order to minimize the necessity of excessive corrective action having to be taken at a later stage in the process.

However, in order to incorporate insects into sustainable food policy a better understanding of the environmental impact of insect production systems through consequential life cycle assessments is needed while ensuring appropriate legislation is in place to address the concerns highlighted above. Moreover, impact assessment of increased insect consumption and demand, and the effect on ecosystems are needed.

### **Conclusion**

Addressing insects as a novel food focuses primarily on food safety and consumer protection. While these issues are highly relevant, they can also undermine the importance of nature conservation, traditional food systems, and economic development. In those countries where there was never a previous need to address regulations concerning insects as food we find that insects have been partially, or completely left out of legislation and decision making. Thus, the development of future legislation must take into consideration the multi-dimensional nature of insects as food and feed.

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## Footnotes

<sup>1</sup> However, it must be noted that there have been no studies published to the knowledge of the authors, which have investigated the bioavailability of micronutrients and proteins from processed and unprocessed insects.