ASIEN 140 (Juli 2016), S. 56–73

Refereed article

Lay People and Experts in Citizen Science: Monitoring Radioactively Contaminated Food in Post-Fukushima Japan

Cornelia Reiher

Summary
The Fukushima nuclear catastrophe of March 2011 created a boom in independent radioactivity monitoring among citizens in Japan. Drawing on three case studies of monitoring stations in Tōkyō, Kanagawa, and Fukushima, this paper analyzes citizens' practices of monitoring radioactively contaminated food from the perspective of citizen science (CS). It explores if and how the Fukushima nuclear catastrophe challenges lay-expert relations, and assumes that there is a difference between expert and lay knowledge. It does so not because the terms "lay" and "expert" are static features of those individuals involved in science, but rather because of the different contexts in which knowledge production takes place. The paper argues that lay-expert relations in Japan have changed to a certain degree since Fukushima, because independent monitoring was first initiated by lay people — thereby empowering nonprofessional scientists. At the same time, independent monitoring offers professional scientists new contexts for the production of "alternative knowledge." Although it is not included in the Japanese government's policymaking decisions, this alternative knowledge has a transformative potential because it is employed by civil society organizations and the antinuclear movement in Japan. Independent monitoring therefore has a (perhaps unintended) subversive character, and should be considered when evaluating the transformative potential of independent monitoring organizations and when talking about civil society and advocacy with regard to scientific issues.

Keywords: Fukushima, citizens' radioactivity monitoring stations, citizen science, lay knowledge

Cornelia Reiher is Assistant Professor for Japanese Society at Freie Universitaet Berlin.

Introduction

In a small apartment in a city in Kanagawa prefecture, Ms. Yamashita[1] takes a hard plastic container, puts 800 grams of brown rice in it, and places the container in a monitoring device to measure the amounts of cesium 134, cesium 137, potassium, and iodine in the sample. The monitoring device is a sodium iodine scintillation detector that cannot detect other radionuclides such as strontium or plutonium, Ms. Yamashita, who is a former chemical engineer at a Japanese electronics maker, explains to me. She adds that monitoring results become more precise the longer the monitoring takes; to demonstrate the general procedure, she however sets the timer only for one hour. The monitoring device is connected to a computer. Several numbers and figures appear on the screen and Ms. Yamashita shows me the results for each individual substance. After the hour is up, the monitoring results reveal two becquerels per kilogram (bq/kg) of cesium 137 in our sample of brown rice. Ms. Yamashita tells me that the results will later be published on the monitoring station's website.

After the Fukushima nuclear catastrophe in March 2011, citizen radioactivity monitoring stations (*shimin hōshanō sokuteisho*, or CRMS[2]) similar to this one mushroomed up all over Japan, and especially in the Kantō and Tōhoku regions. By 2012 more than 100 CRMS existed. Because of a lack of information and high levels of mistrust in the Japanese government's ability to regulate food safety after the nuclear catastrophe (CAA 2015; Hosono et al. 2015), people were worried about radioactively contaminated food. Therefore, many citizens started to acquire scientific and technical knowledge to learn about radionuclides and their possible effects on human health. This led many citizens to collect data to help them judge what was safe to eat. As a result of the nuclear catastrophe, science was closing in on everyday life (Morris-Suzuki 2015).

The Japanese Food Safety Commission (FSC) and the Ministry of Health, Labour, and Welfare (MHLW) set provisional threshold levels for radionuclides in food in 2011, and final levels in 2012. They then argued that these safety standards were based on science and therefore citizens should not worry about food safety. Bureaucrats and scientists involved in the assessment and management of food risks in Japan deemed anxious citizens to be ignorant and incapable of understanding science. They also asserted that harmful rumors and the mass media's lurid headlines simply stirred up citizens' feelings (Interviews with officials from the FSC and several scientists from the FSC's expert committees, July 2015). These experts' depiction of the public as ignorant illustrates what Wynne calls the "deficit model of public understanding of science" (1993: 322). While, to me, Ms. Yamashita from the

1 For the sake of anonymity, the names of all interview partners in this paper are pseudonyms.

2 The abbreviation CRMS also refers to the name of the organization Citizens Radioactivity Measuring Station. As used here, however, it does not refer to a particular organization but rather only to the phenomenon in general.

CRMS in Kanagawa seemed quite knowledgeable about radiation and monitoring, scientific and political communities often claim that "the public has a limited capacity to understand certain kind of risks […] and they have nothing to add from a knowledge perspective" (Lidskog 2008: 71). Yet even among scientists, the question of radiation and its impact on human health is a highly debated and contested issue (Iwata et al. 2012; Kimura 2013; Morris-Suzuki 2014; Pflugbeil and Dersee 2011).

The Fukushima disaster raised pertinent questions about the construction and communication of scientific knowledge. One of these concerns the relationship between expert and lay knowledge. Governments increasingly have to make decisions on issues related to science and technology. Therefore, many scholars and practitioners see public participation in these issues as a solution to the decreasing levels of trust and the challenges of technoscience (Brown 2009; Fujigaki 2009; Gibbons et al. 1994; Lidskog 2008; Wakamatsu 2011). This is also true for food-related issues such as genetically modified food, functional foods, or food additives (Kimura 2012; Philipps 2008). However public participation in decision-making processes about scientific issues in Japan is often limited to public comments or public consultation activities within or outside of deliberation councils and does not often result in different outcomes (Kadomatsu 2011; Kimura 2013; Nishizawa 2005). Usually it is experts — most of them professional scientists in expert committees (*senmon chōsakai*) — who advise policymakers on scientific issues. Scientific data or other knowledge produced by lay people is seldom considered. In the case of irradiated food in post-Fukushima Japan, lay people's knowledge thereof was not considered relevant by the Food Safety Commission when safety thresholds were set — as revealed by the FSC's risk assessment report (FSC 2011; Kimura 2013).

Assuming an anthropological perspective, this paper analyzes if and how the Fukushima nuclear catastrophe has challenged lay-expert relations in regard to radioactively contaminated food. In the literature from science and technology studies (STS), expert and lay knowledge are often conceptualized as "discrete sites" (Bucchi and Neresini 2007: 466), but I will argue here that "lay people" and "experts" are not static concepts. By stressing their open and processual character, I will show how lay people can *become* experts by engaging in the monitoring of radionuclides in food. I will focus on the particular contexts in which knowledge about radiation in food is produced by CRMS in Japan. This takes into account Finke's (2014) argument that it is not the status of the actors involved, but rather the context in which science takes place that creates the differences between lay and expert knowledge. Focusing on lay-expert relations in citizen science (CS), this paper aims to contribute to STS on Japan — specifically by analyzing how knowledge on radioactively contaminated food is produced. It also shows how policymakers and professional scientists hierarchize this knowledge as either irrelevant lay knowledge or relevant expert knowledge. In this way, the paper provides a new perspective on power relations within Japanese society.

In order to elaborate the concepts of lay person and expert in the realm of science and scientific knowledge about irradiated food in Japan, I will analyze the radioactivity monitoring practices of Japanese citizens, their understandings of and interactions with experts, how they acquire and — at the same time — produce knowledge, and how they view their own role. Drawing on three case studies of monitoring stations in Tōkyō, Kanagawa, and Fukushima, I will answer these questions based on qualitative interviews, participant observation, and the analysis of CRMS websites — as well as their publications and meeting protocols.[3] I also draw on other interviews with officials from national government agencies, farmers, consumer cooperatives, as well as scientists who are members of the FSC's expert committees. These were all conducted in different locations across Japan in 2012, 2013, and 2015.

Citizen science: Lay people versus experts?

Public participation in science can be observed in many different forms: from grassroots to institutionally led (Bucchi and Neresini 2007: 464). Approaches such as the "new production of knowledge" (Gibbons et al. 1994) or Funtowisc and Ravetz's (1990) concept of "postnormal science" have attempted to change the relationship between lay people and experts. While Gibbons et al. posit that only well-educated citizens can participate in scientific debate, Funtowisc and Ravetz attribute lay people with having only a supporting role to play in the traditional production of scientific knowledge. Scholars writing about CRMS in Japan (Kimura 2015; Sternsdorff 2012, 2013) often use the aforementioned term citizen science, first coined by British sociologist Alan Irwin in 1995. His concept aims at renegotiating the relationship between science, technology, and citizens. According to him, science should respond to citizens' demands at an immediate, local, and contextually appropriate level, and is furthermore enacted by citizens themselves (Irwin 1995).

CS, according to Finke (2014), is a heterogeneous movement, and its variations oscillate along a continuum between two poles: CS light and CS proper. While the former is a dependent form of research that often incorporates lay people into academic research projects overseen by professional scientists, the latter refers to independent research undertaken by citizens themselves. Citizen scientists are very often involved in research into practical problems such as environmental risks, but their activities are not exclusive to the natural sciences. CS literature and current practice, however, often neglect the emancipatory aspect of CS envisioned by Irwin, and reduce citizen scientists to volunteers who collect or process data as part of a scientific enquiry — such as bird counts by amateur birdwatchers (Silvertown 2009: 467). Nakayama (2009: 194), however, envisions another type of what he calls

3 The interviews were conducted in Japanese. All translations of interviews and documents from Japanese are my own.

"service science," with it working the other way around: instead of citizens helping scientists, scientists rather address citizens' needs. Other authors agree that expert knowledge should be more responsive to the needs of society and take into account place-based knowledge to foster the legitimacy of science-related policymaking (Takao 2015: 2). As Wynne (1989) has pointed out, locals might have their own expertise that scientists need to draw on to solve particular environmental problems.

Therefore, CS as envisioned by Irwin (1995: 176, 177) is an arena wherein different knowledge claims can meet and cross-pollinate. Citizens should be included in scientific priority setting. Local- and citizen-defined initiatives that seek to make sense of science within the conditions of everyday life should be supported, and scientists should be educated in the wider dimensions of the relationship between science and society. In Irwin's later writings (Irwin and Michael 2003), the distinction between the lay public and experts vanishes altogether. He no longer considers the public a lay community, but rather a highly knowledgeable community instead. "The public" and "science" cease to exist as distinct entities, and are replaced by assemblages, coalitions, and hybrid groups that deliver statements that weave in and out of the expert and lay domains (Lidskog 2008).

In a similar manner, Finke (2014: 15) argues that CS itself is science — and thus the conventional distinction between lay people and experts ceases to exist. He argues, however, that although lay people can become experts they are still not professional scientists. He stresses that this distinction is important to make because research practices are influenced by the institutional contexts in which science takes place. Lay people have limited financial resources and time (Lidskog 2008; Takao 2015), and lay knowledge is qualitatively different from that produced by professional scientists — because the former aims at creating and disseminating knowledge from an independent perspective, outside of institutional constraints. Often, citizen scientists do not see themselves as scientists at all (Bucchi and Neresini 2007; Finke 2014; Lidskog 2008). Since expertise is relational and contested between experts and lay people, also within science, the lay-expert distinction should thus be replaced by a distinction made between knowledge production in *professional science contexts* and in *lay contexts*.

CRMS in Post-Fukushima Japan

CS, if understood as lay people cooperating with professional scientists, is not entirely new to Japan. Examples of the coproduction of knowledge are the Society for Corporate Research in Earth Science (Chidanken) that was founded in 1947, the ethnographic study group inspired by the late Yanagita Kunio, and a group of amateur astronomers organized by Yamamoto Issei. Nakayama calls these early lay people in science "grass-root scientists" (2009: 90). In the 1960s and 1970s environmental activist scholars like Ui Jun coproduced knowledge with industrial pollution victims, and Ui's (1991, 1992) independent public lecture series on

pollution (*jishu kōgai kōza*) had a great impact on Japan's environmental movement and fit more into Nakayama's category of service science mentioned above. CRMS, however, are initiated by lay people, not by professional scientists. Although cooperation with professional scientists does exist, CRMS' data is usually not used for research at universities — whereas data collected by the MHLW has become the foundation of research articles on radiation in science journals (Merz et al. 2015). Unlike the environmental movement of the 1960s and 1970s, CRMS are not using the knowledge they produce for protest or advocacy-related activities. Their main goal is simply to provide consumers or farmers with data about radionuclides in food, in order to help them to make better informed food choices in everyday life.

After the nuclear catastrophe, the Japanese government assured consumers that all food being sold was within safe limits of irradiation. However some consumers (especially parents), consumer advocacy groups, and other civil society organizations, criticized the monitoring carried out by municipalities, prefectures, and state-run facilities as insufficient — especially in the immediate aftermath of the disaster (Aoki 2012; Reiher 2012). According to Article 29 of Japan's Food Hygiene Law (*shokuhin eiseihō*), it is the duty of the municipalities and prefectures to inspect food. This includes the monitoring of contaminated food. Municipalities and prefectures, however, did not possess the financial resources to establish a monitoring system for radionuclides in food in the period directly after the nuclear catastrophe. Government support started slowly, and as a consequence some municipalities started to lease monitoring devices initially (Nakamura and Koizumi 2011). The MHLW and the Ministry of Agriculture, Forestry, and Fisheries (MAFF) also started to monitor food and published the results on their websites starting from March 2011 (MHLW 2015; MAFF 2015). Consumer cooperatives like Seikyō, Seikatsu Club, and Daichi o mamoru-kai — and even supermarket chains like Aeon — also monitored food. Some of them even adopted safety thresholds that were stricter than the official ones that had been established by the Japanese government itself (Kimura 2013; Reiher 2012). In the Fukushima area, agricultural cooperatives (Nōkyō or JA) also offered monitoring to farmers (Interview with Fukushima farmer Ikeda Ichirō, February 2012).

Many consumers however did not trust the monitoring results published by the Japanese government. Consumer cooperatives, JA, and food retailers only monitored their own products (Reiher 2012). Consequently the first CRMS were founded a few months after the nuclear accident in Fukushima, some of them in apartments in residential houses, others in facilities provided by existing organizations. CRMS monitor food and soil on demand, not systematically, because they do not have access to the same resources that the official authorities or consumer co-ops do. Producers and consumers who either pay a monthly membership fee or each time they request monitoring bring or send food or soil to the CRMS. Most of the CRMS are open only a few days per week. Some own only one monitoring device, others up to three; they cost between 2 and 12 million yen each (20,000–120,000 euros).

The number of available monitoring devices, extent of financial resources to cover rent and electricity, and small number of volunteers who are involved in the monitoring limit the monitoring capacities of each individual CRMS. While some of the CRMS, especially within Fukushima prefecture, cooperate with local JA, municipalities, and consumer cooperatives, there exists no general cooperation. However consumer cooperatives and advocacy groups positively acknowledge CRMS' activities, and do indeed refer to their data (Interviews with Seikatsu Club official Kawamura Seiji and Nihon Shōhisha Renmei official Ide Hiroyuki, February 2012).

CRMS have decreased in number from more than 100 monitoring stations in 2012 to about 70 in 2015 (Interview with CRMS member Kanetake Kōichi, August 2015; Marumori 2013). Reasons for closing CRMS are often of the financial kind; maintenance costs are difficult to cover when the number of requests for monitoring are declining. This tendency is related to a decrease in public interest in the topic in the two years following the disaster. According to one informant (Interview with CRMS member Horie Daisuke, March 2013), the decrease has also been influenced by claims from the mass media and the government that everything is back to normal. CRMS are also criticized by government officials for undermining the government's efforts to present the new safety standards for radionuclides in food as reliable, and the monitoring system as sufficient (MAFF 2012).

Partly because of this criticism from the central and local governments, most CRMS dissociate themselves from the antinuclear movement — as they think any alignment with it would compromise the scientific objectivity of their results (Interview with CRMS member Yuo Hidefumi, July 2015). For the same reason, since 2013 some CRMS have increasingly strived to standardize monitoring practices so as to make results comparable — despite the fact that the monitoring devices used by the various CRMS differ. Kimura (2015) argues that another reason why most CRMS want to distance themselves from politics and the antinuclear movement is that they do not want to be linked to radical new left groups.

It is important to note that CRMS are heterogeneous: the motivations, skills, and social networks of the people who run them differ greatly. Therefore, the following section introduces three CRMS from Fukushima, Tōkyō, and Kanagawa that are different with regard to practices and goals, lay-expert relations, and cooperation with (local) government authorities. Local factors such as embeddedness in the community, distance from the Fukushima nuclear power plant, and available financial and time resources also differ greatly. The cases presented here are not representative of the approximately 70 CRMS that currently exist in Japan, but nevertheless still offer in-depth insights into the production of knowledge in a lay context. I conducted interviews with one or more representatives from the three CRMS in 2013 and 2015, visited the CRMS in question, and participated in the formative meeting of a joint website project by a group of CRMS — where I met my

informants for the first time. The introduction of the CRMS will mainly focus on the perspective of the founders, and give an account of their motivation, expertise, learning processes, and their perception of the CRMS' relationship to the (local) government(s).

A Fukushima-based CRMS

Horie Daisuke, whom I interviewed in March 2013, is one of the founders of a network that now runs nine monitoring stations in Fukushima prefecture[4] and one in Tōkyō. The Fukushima CRMS was the first monitoring station that he founded. This he did together with a journalist and with volunteers from the Fukushima Network for Saving Children from Radiation (Kodomotachi o hōshanō kara mamoru Fukushima nettowāku, or FNSCR), most of whom were concerned parents. The CRMS is equipped with three monitoring devices and one whole-body counter. Mr. Horie is an artist who fled to Kyōto right after the nuclear disaster, being shocked about the lack of information available and the attempts by the Japanese government and mass media to play down the events at the Fukushima Daiichi Nuclear Power Plant. His main reason for establishing a monitoring station was his desire for reliable information. The decision came after a trip made to northern Japan together with other volunteers — among them a physicist who monitored the air and soil for radionuclides. Realizing that the contamination of the air with radionuclides was ten to 15 times higher than normal at some places in Fukushima prefecture, he decided to found a monitoring station in Fukushima City.

Right after the triple disaster it was difficult to acquire monitoring devices he said, but with the help of a friend from France and the French NGO Commission de Recherche et d'Information Indépendantes sur la RADioactivité (CRIIRAD) they acquired two scintillation detectors and several Geiger counters. CRIIRAD even produced an educational video to provide Mr. Horie and his team with basic knowledge about monitoring. After a month, they went to Fukushima and started to build their first CRMS together with the FNSCR. They created a website to publish monitoring results online, and then built CRMS in other cities in Fukushima prefecture by providing local citizens — mostly concerned parents — with monitoring devices and the necessary knowledge to use them. At first Mr. Horie and his team traveled the prefecture to monitor schoolyards, parks, and preschools together with these local groups; they then realized that the safety of school lunches caused concern among parents as well. So they started monitoring food. Mr. Horie later founded a joint website where 31 CRMS regularly publish monitoring results. He is also the organizer of the annual Citizen Scientist International Symposium on Radiation Protection (CSRP).

4 They are located in Date, Fukushima (2), Koriyama, Minami Soma, Nihonmatsu, Sukagawa, Tōwa (Nihonmatsu), and Tamura.

When it comes to expertise, Mr. Horie is very confident about possessing sufficient knowledge to satisfactorily monitor radiation — having acquired this knowledge from CRIIRAD members who had been involved in monitoring radiation in France ever since the Chernobyl nuclear accident. Shortly after founding the first CRMS in Fukushima City, he distributed monitoring devices to other local groups in Fukushima pefecture and taught them how to use them. Ever since his first trip to Tōhoku, he has had contact with scientists and radiation experts from universities and civil society organizations and continued to learn from them. The organization cooperates with a number of scientists: for example, medical doctors from the National Network of Pediatricians for Protecting Children from Radiation (Marumori 2011). Regular study groups take place with all member CRMS. At these meetings they study, discuss, and consolidate monitoring methods, quality control, and data input on the joint website. This knowledge exchange is not restricted only to the ten member CRMS in Fukushima and Tōkyō that belong to Mr. Horie's network, but takes place also with other organizations who ask for help with the founding of their own monitoring stations. Mr. Horie and his team also offer workshops, seminars, and training sessions. Although Mr. Horie is quite confident about his expertise in monitoring radiation and entering the results into a database, he sees his expertise as being limited with regard to the interpretation of the monitoring results. Although his organization provides its clients with general information on radiation risks, it does not advise consumers on whether something is safe to eat or not. Among my interview partners he was the only one to use the term citizen science, a term he used in English, to describe what he does.

Quality and independence are very important to the member organizations of this CRMS network. This became evident when in 2013 the director of the network released an announcement in which she distanced herself and her associates from others that were using the same name, but who were either pronuclear or close to far left political groups — and who thereby threatened her organization's reputation for providing monitoring results of a high quality, using standardized monitoring methods (Marumori 2013). The organization usually avoids cooperation with local authorities for the same reason. However Mr. Horie's experience with the local government in Fukushima is ambivalent, because there have been situations where the latter has responded to the CRMS' request — for example by helping to acquire whole-body counters to monitor radiation in humans.

A Tōkyō-based CRMS

Kanetake Kōichi founded a CRMS in a municipality in the west of Tōkyō metropolis in December 2011; I interviewed him there in August 2015. He is a freelance web designer who had been involved in work with children and the movement for natural parenting (*shizen ikuji*) before the Fukushima nuclear disaster. He is also the chief director of the joint CRMS website project that Mr. Horie

initiated. They met when Mr. Kanetake joined the FNSCR in July 2011. Mr. Kanetake organized local meetings in his community, and started to monitor radiation in schoolyards, parks, and childcare facilities in the area together with local officials from the municipal government who were very concerned about radiation. Most participants at the meetings in his community were concerned parents, with food safety issues being commonly discussed. Mr. Kanetake, who was himself very anxious, recalled in our 2015 interview that when food products from Kantō and Tōhoku were steadily beginning to fill the shelves of supermarkets and co-ops in Tōkyō in the summer of 2011 he decided he could not eat these vegetables. He then initiated a workshop to learn about monitoring and radiation, and purchased two Atomtex scintillation detectors. Mr. Kanetake, who had just received a payout from his life insurance, paid for one of the detectors with his own money. The other one was donated by the Act Beyond Trust, a foundation that supports nongovernmental organizations who are active in the environmental sector.

When I interviewed Mr. Kanetake he told me that, as is the case with most CRMS, the number of requests for monitoring had declined of late, but financial resources are stable. This is mainly related to the CRMS' location next to a famous organic restaurant that also offers office space to certain civil society organizations. Because of the many health-conscious customers passing through, Mr. Kanetake and his team opened a store for environmentally friendly and ecological cosmetics, clothing, and baby products to generate the necessary revenue to cover the maintenance costs for rent and electricity. The monitoring devices are located in the shop. Because Mr. Kanetake is a freelancer, he also has time for monitoring. Monitoring takes place two to three times a week. By the beginning of 2015 Mr. Kanetake and Ishihara Yūsuke, an agricultural scientist, had monitored more than 2000 items of food. Besides Mr. Kanetake and Mr. Ishihara, two female volunteers (whom I also interviewed) help with monitoring, and documenting the results. Mr. Kanetake has also recently launched a new project to monitor and map hotspots across the whole country. He collects soil samples together with both members of other CRMS and friends from all over Japan.

In our interview Mr. Kanetake stated that he has no scientific background, although he always liked science in school and at university; however he does not consider himself an expert. After he became involved with the CRMS network he mostly learned about monitoring and radiation through discussions in mailing lists and on internet fora, as well as by studying publications. In these online discussions there were many people who had experience with monitoring radiation, some of them professional scientists — but also engineers, alongside people from environmental movements as well. Additionally Mr. Ishihara, the agricultural scientist and deputy director of the CRMS, already had some experience with measuring all kinds of trace element in food. He trained Mr. Kanetake, who described this process as learning by doing.

Mr. Kanetake has gone from being a student to being someone who now educates others about monitoring and radiation. Together with Mr. Ishihara, he organizes a monthly workshop where participants pay a fee of 1500 yen to learn about radiation and ask questions that also touch upon the interpretation of monitoring results and food choices. Together with Mr. Ishihara he has published an information brochure that contains interviews with professional scientists (a physician and an environmental scientist) and members of other CRMS, alongside a comic-style guide on how to protect oneself from irradiated food, soil, and air in everyday life. The brochure also includes a glossary of scientific terms related to radiation. Mr. Kanetake and Mr. Ishihara themselves feature in this comic, as characters who educate others. They also run a mail magazine, appear on social media, and produce short video clips wherein they discuss matters related to radiation.

A Kanagawa-based CRMS

The third CRMS, one where I conducted two group interviews in March 2013 and July 2015,[5] is located in a residential area of a city in Kanagawa Prefecture. It is also part of the CRMS joint website project and opened later than most CRMS, in February 2013. According to Yamashita Keiko, the chemical engineer I introduced at the beginning of this paper, the main motivation for starting a monitoring station was the lack of information on radiation in food and the local government's refusal to monitor radiation in school lunches. As a representative of the people from his neighborhood, Mr. Yuo, who is the current representative of the CRMS, requested several times that the local government build a radiation monitoring station — but his requests were in vain. As a consequence, those who were concerned about food safety gathered at the local organic food store and came up with the idea of founding their own monitoring station. The shop became a center for networking and fundraising. By fall 2012, they had collected enough money — mostly from local residents and shop owners — to buy a sodium iodide scintillation detector.

Most of the around ten volunteers who run the CRMS live in its vicinity, and some already previously knew each other from parent networks, civil society organizations, or discussion groups before they joined the CRMS. A woman whom the CRMS members know from the organic food store allows the CRMS to occupy a small apartment for free. Mr. Yuo is sure that it is because rent and electricity are free that the CRMS still exists, in spite of the decrease in monitoring activities due to fewer orders coming in. The CRMS opens twice a week. For a fee, citizens can bring food or soil samples for monitoring. Some of the CRMS' customers are friends and relatives, others have learned about the monitoring station through leaflets, newspaper ads, or the CRMS' website. As of 2015 they have so far only

5 During the first interview in 2013, I spoke to five people. In 2015, I spoke to six people and I also visited other CRMS together with Ms. Yamashita.

found very small amounts of cesium 134: the highest measurement thereof was 50 bq/kg.

The CRMS has also a social function. It provides a space for citizens to discuss and exchange their opinions and concerns about radiation. According to Ms. Yamashita, this type of social interaction is often otherwise impossible because national and local governments now claim that food is safe and that radiation does not pose any health risks — thereby marginalizing those who continue to be concerned about these issues. Although the CRMS challenges this dominant view and its members criticize the government's food safety thresholds for radionuclides, they dissociate their CRMS from the antinuclear movement. While individual members sympathize with its goals and join rallies (in fact that is how some of them met before opening the CRMS), the CRMS does not officially show solidarity with the movement. This is because "some people who worry about radiation ask us to monitor food, but they do not want anything to do with political camps. That is why these people do not want us to discuss a nuclear phase-out in the monitoring station" (Interview with CRMS member Yamashita Keiko, March 2013).

The differences between experts and lay people seem to be more important in this CRMS in Kanagawa than they are in the other two cases. Only two members of the CRMS are considered to be experts by the others: Ms. Yamashita, who is a chemical engineer, and a professor emeritus of Atomic Physics. Mr. Yuo mentions that up until the point when the monitoring station actually opened, all activities were carried out by lay people. However when the monitoring device eventually arrived, they did ask for help from the two experts. In the beginning, the physicist came every day to explain the monitoring process and to set up the device and provide basic information about radiation. The CRMS members later participated in a course on radiation that he taught. Ms. Yamashita took over responsibility for monitoring, and contacted the monitoring device's manufacturer when things were not working. She monitored food together with the others, and explained to them how the device worked (Interview with CRMS member Yuo Hidefumi, July 2015). Although the CRMS does not run its own study group on the impact of radiation on human health, it joins other study groups led by university professors or other CRMS.

The other members stress that they do not have a scientific background. Some are retired high school teachers, while others work as salary men. A division of labor exists between the professional members and the other members of the CRMS. One member, Mr. Honda, maintains the CRMS' website, while another female member is in charge of social networking and hospitality. Although Mr. Honda stated that he does possess some basic knowledge about radiation and physics, and continues to study these topics, he nevertheless still distinguishes himself from the professional (*puro*) scientist Ms. Yamashita. During my visits any questions about the monitoring itself were passed on to Ms. Yamashita, who was considered the most knowledgeable authority by the other members. Ms. Yamashita, like Mr. Horie from

the CRMS in Fukushima, does not think of herself as an expert when it comes to the interpretation of the monitoring results though. Therefore, in the CRMS in Kanagawa, customers are not offered any advice on whether they should or should not eat certain food products.

Comparison of the three cases

While the motivation to found a CRMS is quite similar for all three of the CRMS I have introduced here, their scope, local contexts, the relationship with the respective local government, and lay-expert relations are quite different in the cases presented here. In general, the people who were referred to as experts and the terms used to express this were quite different: among them were specialists (*senmonka*), professionals (*puro*), scientists (*kagakusha*), and professors (*sensei*). My informants used these three terms to describe professional scientists who worked or still work in a *professional context* at research institutions, most of them in Environmental Science, Physics, Medicine, or the applied sciences— but also technical engineers or members of other monitoring stations. Even if monitoring radiation in food is not part of their professional background, related experience often counts as expertise as well. Most members of CRMS that I interviewed did not see themselves as scientists or experts for radiation; however Mr. Horie and Mr. Kanetake were rather confident about their achieved level of expertise in monitoring radiation in food, soil, and the air. Members of the CRMS in Kanagawa also referred to these two individuals as experts; Mr. Horie even travels abroad to represent the monitoring movement in Japan. I would therefore argue that they have come to be experts for monitoring radiation, even though they are not professional scientists by trade.

The cooperation with professional scientists or activists with experience in monitoring radionuclides (not necessarily in food) has been an important source of knowledge and learning in all three cases. Cooperation with universities and individual scientists exists. While universities often only provide resources for building networks or giving advice, individual scientists work with CRMS outside of their professional contexts. To this point, I do not know of any cases where professional scientists use CRMS data for their research projects. However the professional scientists that CRMS members cooperate with are carefully selected according to their stance on radiation. Those scientists who are pronuclear and who downplay the risks posed by radiation are unlikely to be selected as cooperation partners. Science itself, however, remains a resource for the identity, organization, and activity of the CRMS (Bucchi and Neresini 2007). This becomes evident in the attempt to distance CRMS from political actors and from other CRMS whose monitoring practices are considered to be qualitatively inferior, a position taken in order to appear genuinely objective and scientific. Accordingly, all three organizations put great effort into continually improving their monitoring practices and the comparability of the results that they publish on the joint CRMS website.

The experience of cooperation with local government is different in all three cases: In Fukushima, cooperation was at least possible in some cases, as the example of the whole-body counter illustrates. However when it comes to monitoring, the CRMS' independence is important to Mr. Horie. In the example from Tōkyō, the local government actively supported the monitoring of air, soil, and food. In Kanagawa, meanwhile, the local government refused to cooperate with the monitoring of food.

Although all three CRMS are members of the joint CRMS website project, their scope is different: That of the CRMS in Kanagawa is mainly local. It mostly caters to people from the city, and tends to use CRMS networks to improve its own practices rather than to educate others. The CRMS' activities can be described as what Morris-Suzuki calls "informal life politics" (2015: 170): a way of responding to challenges to people's livelihood by organizing themselves and taking actions outside the sphere of formal governmental structures. Mr. Horie's and Mr. Kanetake's initiatives are much more about the "bigger picture," yet they do not actively collaborate with the antinuclear movement nor do they lobby the government to achieve stricter safety thresholds for radionuclides in food. Mr. Kanetake's knowledge about web design enables him to disseminate widely information from his CRMS via the internet. Mr. Horie not only runs his own CRMS network but also initiates joint projects with other CRMS and supports them. He also cooperates with international experts and organizations.

Conclusion: Beyond the lay people-expert dichotomy?

Citizen science, as practiced at most CRMS, is limited to monitoring, and thus does not include participation in professional science or politics in a stricter sense. However CRMS have produced a large body of open-access data on the radioactive contamination of food in post-Fukushima Japan that can be accessed via the internet by everyone. To collect data on radiation is the main goal of CRMS, since it was the lack of official information that created a boom in independent monitoring of radiation in food, air and soil. This was initiated by lay people, and thereby empowers nonprofessional scientists, offers professional scientists alternative contexts for the production of knowledge, and, most importantly, leads to the creation of an alternative body of knowledge that helps many people who do not trust the Japanese government to make everyday choices. Although it is important to some members of CRMS to differentiate between experts and lay people within their own organization, some of the citizen scientists I introduced in this paper became experts — both from their own perspective and from that of others. By incorporating professional scientists into CRMS activities, the distinction between lay and expert knowledge also becomes blurred. Therefore, I argue that lay-expert relations with regard to radioactively contaminated food have changed to a certain degree post-Fukushima — by new contexts of knowledge production being created.

With regard to CRMS' relationship to Japanese society, Kimura (2015) argues that CRMS have taken over some of the functions of public authorities by providing information and monitoring food — as a form of outsourcing of governmental responsibility under a neoliberal regime. Samuels (2013: 132) addresses the lack of social mobilization and observes that Japanese citizens seemed more concerned than outraged. Although it is true that CRMS want to provide citizens with information/knowledge about radiation rather than to change the political system, I argue that CRMS do not simply create *additional* knowledge to fulfill public authorities' functions but rather to produce *alternative knowledge*. This alternative knowledge does indeed relate to formal governmental structures, for example when public authorities such as MAFF (2012) officially criticize CRMS' activities because they feel threatened and fear that independent monitoring undermines the official line that all food grown in the country is now safe.

The (perhaps) unintended subversive character of alternative monitoring also becomes evident in the difficulties that CRMS face when they cooperate or attempt to cooperate with local authorities, and when their monitoring practices receive criticism from public authorities. Although CRMS are not — at least not officially — involved in advocacy and protest, other advocates can and do base their arguments on the knowledge about the radioactive contamination of food produced by CRMS. Consumer advocacy groups for example use CRMS data when arguing for stricter safety thresholds for radionuclides in food, and also refer to CRMS' activities (CUJ 2013). When evaluating CRMS' transformative potential, and when talking about civil society and advocacy with regard to scientific issues, we should pay more attention to the (scientific) knowledge itself on which the ideas, requests, opinions, and arguments employed by civil society organizations are based, and indeed to the actors who produced this knowledge. However, so far, CRMS members have not been invited to participate in the government's deliberation councils on radiation, nor has their data considered. Especially with regard to the assessment of food risks, it is still the opinion of professional scientists that matters most (Kimura 2013; Yamaguchi 2014) — that despite some experiments with more inclusive research formats, such as the consensus conference (Nishizawa 2005; Wakamatsu 2011). When it comes to food risks, therefore, I am not as optimistic as Fujigaki (2009), who argues that Japan is shifting from a technocratic to a more democratic model in science and technology decision making.

While it is easy to include lay people in an ornithological project on bird numbers, citizens who actually question professional scientists' assumptions — even if they do not do so explicitly — by independently monitoring food are challenging the relations between politics, science, and the citizenry in Japan. However CRMS' knowledge has not been included in political decision-making processes there to date. Therefore, I argue that policy makers and the professional science community (not only) in Japan have not yet overcome the hierarchization of different kinds of knowledge which is not based on the quality of the knowledge itself but rather on

the position and affiliation of the people who produce it. So far, the view that different knowledge fields all contain specific sources of expertise has not successfully entered into political science and technology decision-making practices and thinking in Japan. As such spaces for deliberation and negotiation should be created, because locally derived knowledge *and* knowledge acquired through higher education may, to varying degrees, be seen as relevant when confronting risks (Lidskog 2008; Nakamura 2011). Unfortunately, there is hardly any knowledge exchange between state institutions or higher education institutions and CRMS. It is therefore not yet possible to speak about a democratization of science with regard to knowledge about irradiated food in post-Fukushima Japan. Although it might not have any effects in the near future on research agendas and decision-making processes "when citizens speak back to science" (Lidskog 2008: 81), I argue that knowledge production itself has already changed — because the CRMS' knowledge is out there, and accessible to everyone. Whether and how it will enter into political decision-making processes, who will use it, and for what purposes remains to be seen. To study this process is an exciting endeavor for STS and Japan scholars alike.

References

Aoki, Mizuho (2012): "Nuclear Awakening. Mothers First to Shed Food-Safety Complacency", in: *Japan Times* (online), January 4, www.japantimes.co.jp/text/nn20120103x2.html (accessed: 2012-01-04)

Brown, Mark B. (2009): *Science in Democracy*. Cambridge, Massachusetts: MIT Press

Bucchi, Massimo; Neresini, Federico (2007): "Science and Public Participation", in: Hacket, Edward J.; Amsterdamska, Olga; Lynch, Michael; Wajcman, Judy (eds.): *The Handbook of Science & Technology Studies*. Cambridge: MIT Press, 449–472

CSRP (2014): "About us", http://csrp.jp/about_us (accessed: 2015-11-30)

CUJ (2013): "Motto motto katsuyō. Shimin ni yoru hōshanō sokuteisho", (More and more usage: Radioactivity monitoring stations by citizens), http://nishoren.net/food_safety/radioactivity/4745 (accessed: 2015-08-14)

Finke, Peter (2014): *Citizen Science: Das unterschätzte Wissen der Laien*. München: Oekom

FSC (2011): *Shokuhin kenkō eikyō hyōka no kekka no tsūchi* (Report on the result of the assessment of food's impact on health), www.fsc.go.jp/sonota/emerg/radio_hyoka_detail.pdf (accessed: 2012-02-02)

Fujigaki, Yuko (2009): "STS in Japan and East Asia: Governance of Science and Technology and Public Engagement", in: *East Asian Science, Technology and Society: an International Journal* 3: 511–518.

Funtowicz, Silvio O.; Jerome R. Ravetz (1990): *Uncertainty and Quality in Science for Policy*. Dordrecht: Kluwer

Gibbons, Michael; Limoges, Camille; Nowotny, Helga; Schwartzman, Simon; Scott, Peter; Trow, Martin (1994): *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*. London: Sage

Hosono, Hiromi; Kumagai, Yūko; Iwabuchi, Mami; Sekizaki, Tsutomu (2015): "Shōhisha ishiki chōsa" (Survey on consumers' perception), in: Tōkyō Daigaku/ JRA (eds.): *Fukushima-ken no chikusangyō fukkō no tame no chōsa oyobi jōhō teikyō jigyō hōkokusho* (Surveys for the Revitalization of Stock Farming in Fukushima Prefecture and Report on the Project for Disseminating Information), 8–23

Irwin, Alan (1995): *Citizen Science: A Study of People, Expertise and Sustainable Development*. London & New York: Routledge
Irwin, Alan; Michael, Mike (2003): *Science, Social Theory & Public Knowledge*. Maidenhead & Philadelphia: Open University Press
Iwata Wataru; Ribault, Nadine; Ribault, Thierry (2012): "Thyroid Cancer in Fukushima: Science Subverted in the Service of the State", in: *The Asia-pacific Journal*, 10.2, www.japanfocus.org/-Iwata-Wataru/3841/article.html (accessed: 2014-11-12)
Kimura, Aya (2012): "Feminist Heuristics: Transforming the Foundation of Food Quality and Safety Assurance Systems", in: *Rural Sociology*, 77.2: 203–224
— (2013): "Standards as Hybrid Forum: Comparison of the Post-Fukushima Radiation Standards by a Consumer Cooperative, the Private Sector, and the Japanese Government", in: *International Journal of Sociology of Agriculture and Food*, 20.1: 11–29
— (2015): "Citizen Science in the Age of Neoliberalism and Neoliberal Feminism: Citizen Radiation Measuring Organizations (CRMOs) after the Fukushima Nuclear Accident", Conference paper given at the Symposium "Food Safety and Consumer Advocacy in Japan and East Asia", JDZB Berlin, May 19, 2015
Lidskog, Rolf (2008): "Scientised Citizens and Democratized Science: Re-Assessing the Expert-Lay Divide", in: *Journal of Risk Research*, 11.1–2: 69–86
MAFF (2012): *Shokuhinchū no hōshaseibusshitsu ni kakawaru jishu kensa ni okeru shinrai dekiru bunseki nado nitsuite* (About the trustworthiness of the analysis and independent monitoring of radionuclides in food), www.maff.go.jp/j/press/shokusan/ryutu/pdf/kyoukucho.pdf (accessed: 2014-05-23)
— (2015): "Suisanbutsu no hōshasei busshitsu no chōsa kekka" (Monitoring results of radionuclides in seafood), www.jfa.maff.go.jp/j/kakou/kensa/index.html (accessed: 2015-01-21)
Marumori, Aya (2011): "Group Introduction: Citizens' Radioactivity Measurement Station (CRMS)", www.cnic.jp/english/newsletter/nit144/nit144articles/group144.html (accessed: 2015-11-15)
— (2013): "Announcement from the Citizens Radioactivity Measuring Station", https://www.facebook.com/wataru.iwata.54/posts/615232065195082 (accessed: 2015-11-15)
Merz, Stefan; Shozugawa, Katsumi; Steinhauser, Georg (2015): "Analysis of Japanese Radionuclide Monitoring Data of Food Before and After the Fukushima Nuclear Accident", in: *Environmental Science & Technology* 49: 2875–2885
MHLW (2015): „Shokuhinchū no hōshasei seshiumu kara ukeru hōshanō senryō no chōsa kekka", www.mhlw.go.jp/file/04-Houdouhappyou-11134000-Shokuhinanzenbu-Kijunshinsaka/20 151120.pdf (accessed: 2015-11-15)
Morris-Suzuki, Tessa (2014): "Touching the Grass: Science, Uncertainty and Everyday Life from Chernobyl to Fukushima", in: *Science, Technology & Society*, 19.3: 331–362
— (2015): "Re-animating a Radioactive Landscape: Informal Life Politics in the Wake of the Fukushima Nuclear Disaster", in: *Japan Forum*, 27.2: 167–188
Nakamura, Masaki (2011): "Kagakugijutsu komyunikēshon no seisakuteki shinkō" (The political promotion of science and technology communication), in: Yoshioka, Hitoshi, Ayabe, Hironori, Kuwahara, Motoko, Tsukahara, Shūichi; Kawano, Yūji (eds.): *Shintsūshi. Nihon no kagakugijutsu Volume 3: Seiki tenkanki no shakaishi 1995 – 2011 nen*, Tōkyō: Hara shobō, 577–598
Nakayama, Shigeru (2009): *The Orientation of Science and Technology: A Japanese View*. Folkestone: Global Oriental
Nishizawa, Mariko (2005): "Citizen Deliberations on Science and Technology and their Social Environments: Case Study on the Japanese Consensus Conference on GM Crops", in: *Science and Public Policy*, 32.6: 479–489

Philipps, Axel (2008): *BSE, Vogelgrippe & Co. „Lebensmittelskandale“ und Konsumentenverhalten. Eine empirische Studie*. Bielefeld: transcript

Pflugbeil, Sebastian; Dersee, Thomas (2011): “Kalkulierter Strahlentod. Die Grenzwerte für radioaktiv verstrahlte Lebensmittel in der EU und in Japan”, KalkulierterStrahlentod_Report_foodwatch_IPPNW2011-09-20_D.pdf (accessed: 2011-10-13)

Reiher, Cornelia (2012): “Lebensmittelsicherheit in Japan nach Fukushima: Produzenten vs. Konsumenten?”, in: Wieczorek, Iris; Chiavacci, David (eds.): *Japan 2012*. Berlin: VSJF, 283–307

Samuels, Richard (2013): *3.11: Disaster and Change in Japan*. Ithaka: Cornell University Press

Silvertown, Jonathan (2009): “A New Dawn for Citizen Science”, in: *Trends in Ecology and Evolution*, 24.9: 467–471

Sternsdorff-Cisterna, Nicolas (2012): “Spaces of Uncertainty in the Food Supply after Fukushima”, http://fukushimaforum.wordpress.com/online-forum-2/online-forum/spaces-of-uncertainty -in-the-food-supply-after-fukushima/ (accessed: 2013-10-10)

— (2013): “Safe and Trustworthy? Food Safety after Fukushima”, https://fukushimaforum.wordpress.com/workshops/sts-forum-on-the-2011-fukushima-east-japan-disaster/manuscripts/session-4a-when-disasters-end-part-i/safe-and-trustworthy-food-safety-after-fukushima/ (accessed: 2014-10-10)

Takao, Yasuo (2015): “Making Environmental Policy Work with Civic Science: The Intermediary Role of Expert Citizens at the Japanese Local Level”, in: *Local Environment*, www.tandfonline.com/doi/pdf/10.1080/13549839.2015.1070335 (accessed: 2015-10-23)

Ui Jun (1991): *Kōgai jishu kōza 15 nen* (Fifteen years independent lectures on pollution), Tōkyō: Aki shobō

— (ed.) (1992): *Industrial Pollution in Japan*, Tōkyō: United Nations University Press

Wakamatsu, Yukio (2011): “Sankagata tekunorojii asesumento no tenkai” (The development of participatory technology assessment), in: Yoshioka, Hitoshi, Ayabe, Hironori, Kuwahara, Motoko, Tsukahara, Shūichi; Kawano, Yūji (eds.): *Shintsūshi. Nihon no kagakugijutsu Volume 3: Seiki tenkanki no shakaishi 1995 – 2011 nen*, Tōkyō: Hara shobō, 599–620

Wynne, Brian (1989): “Sheepfarming after Chernobyl: A Case Study in Communicating Scientific Information”, in: *Environment: Science and Policy for Sustainable Development*, 31.2: 10–39

— (1993): “Public Uptake of Science: A Case for Institutional Reflexivity”, in: *Public Understanding of Science*, 2.4: 321–337

Yamaguchi, Tomiko (2014): “Social Imaginary and Dilemmas of Policy Practice: the Food Safety Arena in Japan”, in: *Food Policy* 45: 167–173