

# Solidarity for Life Viewed through Women's Practice of Citizen Science in Disaster Areas: The Activities of TARACHINE (NPO Mothers' Radiation Lab Fukushima)

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**Abstract** | In modern societies faced with the possibility of various environmental and technological crises, the restoration of normal life without discrimination based on class, race, or gender following a disaster is just as important as techno-rational disaster responses. While research on “disaster vulnerability” and “disaster inequality” has been fruitful in this regard, there is a demand for studies on “disaster justice” from a gender perspective. In this article, I focus on the marginalization and exclusion of women's voices from public discourse in Japan following the Fukushima nuclear disaster. As a case study, I examine TARACHINE (NPO Mothers' Radiation Lab Fukushima), a citizen-science organization in Iwaki, Fukushima Prefecture. I argue that the organization's radiation-measurement activities transcended mere knowledge production pertaining to risk, coordinating relationships between the various people and things constituting the “world of life”; this was the “work of scale” challenging the framework of policies and institutions. In measuring the invisible radiation permeating everything all around them in their daily lives, the women of TARACHINE created a common sense pertaining to their world of life. As a mechanism for seeking out the possibility of life after disaster, these activities constituted the politics of life, an ethic of solidarity, and an effort to change the relations between human beings, material objects, and institutions.

**Keywords** | disaster vulnerability, disaster inequality, the Fukushima nuclear disaster, radiation measurement, citizen science, scale

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## Introduction

On March 11, 2011, an earthquake occurred off the coast of Miyagi Prefecture, Japan. It was the most powerful in the history of modern seismic observation, at 9.0-9.1 on the moment magnitude scale. Across Japan, due the ensuing tsunami and earthquake, 15,000 people lost their lives, 2,500 were never found, 120,000 buildings were destroyed, and 280,000 buildings were partially destroyed. The Japanese government reported the number of disaster victims at 228,864 (Nihon Fukkōchō 2017, 2019). Yet the misfortune did not end there. Following the earthquake and tsunami, the unimaginable occurred when the Fukushima Daiichi Nuclear Power Plant reactor exploded. A month later, the International Atomic Energy Agency (IAEA) forecast that the damage wrought would equal or even surpass that of Chernobyl.

By 2020, a decade later, the number of refugees had fallen from 470,000 to 50,000, with most having left refugee shelters, temporary dwellings, or public housing for permanent residences. In the meantime, evacuation orders for restricted radioactive areas have been gradually lifted, with but a few remaining as of May 2021.

Does this mean that Japan has recovered from the disaster? Japan certainly demonstrated a sophisticated techno-rational response to the disaster, but “recovery” itself is a broader matter. As a result of radiation contamination, diverse social and cultural values and networks supporting the region were instantly destroyed, indelibly changing or eradicating the lives of residents. In this regard, the Fukushima nuclear disaster was particularly significant for the lives of local women. One especially severe problem has been the hatred and exclusion directed at women expressing concern over the risks of radiation exposure, which are expected to last long into the future. Discourse on the internet has even gone so far as to overtly decry the “hysteria of women who worry about the harms of radiation” (Makino 2021). One woman who left Fukushima with her child was even singled out as “selfish and paranoid,” despite the common knowledge that children are more vulnerable to radiation (Yi Yun-suk 2021). Demands for stringent measurement of radiation levels in agricultural and marine products have also been regarded as harmful to good-natured local farmers and fishermen or dismissed as the “complaints of foolish wives who knows little of the hardships of their husbands,” the latter lauded for risking exposure to radiation in working to dismantle the nuclear power plant.

Amid the urgent calls for restoring communities, women in Fukushima have had trouble having their voices heard. In this article, emphasizing the exclusion of women’s voices and lack of a gender perspective in the recovery process

following the Fukushima nuclear disaster, I explore Fukushima women's dynamic practices and activities for solidarity to overcome the crisis. I focus on TARACHINE (NPO Mothers' Radiation Lab Fukushima; Iwaki Hōshanō Shimin Sokuteishitsu),<sup>1</sup> an organization established and run by women residing in Iwaki, Fukushima Prefecture for producing trustworthy information regarding the dangers of radiation since the Fukushima nuclear disaster. I argue that the significance of these women's radiation-measurement activities cannot be reduced to mere citizen knowledge production or scientific, techno-rational policy evaluation regarding the risks of radiation exposure. These activities—carried out by women obliged to live under prolonged and uncertain disaster conditions—instead constitute a politics of life and ethics of solidarity in pursuit of a social imaginary and public life facilitating an alternative mode of being. In this respect, it is a significant endeavor to change the relationship between human beings, material objects, and institutions.

## Disasters and Women

Many studies confirm the special harm wrought by disasters on those belonging to socially marginalized groups, who are politically and economically vulnerable (Fjord and Manderson 2009; Bolin 2007; Filipović and Žakula 2017). Hurricane Katrina, which struck the American South in late August 2005, affected human beings and property on a massive scale due to the federal government's negligence and failures of the state and municipal governments' disaster management systems. The concern for the harm done by Hurricane Katrina manifested within the social sciences, however, is not merely due to the scope of the disaster itself. Those living in low-lying houses near the embankment, who could not afford homes safely located on high ground or external shelters despite warnings over impending dike breeches, were mostly poor African Americans. Such racial and class inequality, moreover, also influenced the disaster recovery process. With ample financial support for recovery, the population of New Orleans soon rebounded to 380,000 after decreasing to 200,000 from 480,000 in the immediate aftermath of the disaster. Tourists also began to return, resuscitating the economy. The proportion of African Americans in the population post-disaster, however, remained at 60 percent, a drop of 10 percent since 2005. As a minority among recipients of disaster insurance, many African Americans who had trouble making ends meet moved

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1. NPO is an acronym that stands for non-profit organization.

away. Overall, the rate of recovery among African Americans was lower than that of white Americans. In a survey, four out of five white Americans reported having “recovered completely” while three out of five African Americans reported having “not recovered” (Kim Hyön-u 2015). The example of Hurricane Katrina thus conveys how the effects of a disaster—although ostensibly a single phenomenon—can greatly vary by race and class, and that there is a clear relationship between varying disaster impacts and economic and social inequalities (Keucheyan 2016).

A disaster is not a fleeting event. Rather, it is a “process/event involving the combination of a potentially destructive agent(s) from the natural and/or technological environment and a population in a socially and technologically produced condition of vulnerability” (Oliver-Smith 1996, 303). Pointing out how “disaster vulnerability” is deeply related with preexisting political, economic, social, and cultural inequalities, Anna Lukasiewicz and Claudia Baldwin (2020) assert the need to consider “disaster justice” in disaster recovery (prevention, preparedness, response, recovery). Such an approach considers the political, economic, social, and cultural inequalities faced by disaster victims and strives to empower them accordingly (Lukasiewicz and Baldwin 2020).

Despite the growing literature on “disaster vulnerability” and “disaster justice,” a gender perspective is still sorely lacking in the actual implementation of disaster response and recovery (Enarson, Fothergill, and Peek 2007; UNDP 2010; Byrne and Baden 1995). As the United Nations Development Programme (UNDP) report in *Making Disaster Risk Reduction Gender-Sensitive: Policy and Practical Guidelines* conveys, there is much evidence showing the greater vulnerability of women to the effects of disasters (UNODRR, UNDP, and IUCN 2009).

Disaster relief and reconstruction efforts with respect to the March 11, 2011 Great East Japan Earthquake likewise evinced a clear lack of gender considerations. The number of female fatalities exceeded that of men, at 8,363 (52.98 percent) versus 7,360 (46.62 percent). Furthermore, the proportion of elderly women among the deceased was markedly high (Ökura 2019).

Yet women make up a group not just more vulnerable to disasters themselves but also more affected by the response and recovery processes (evacuation, reconstruction, etc.). The Japan Business and Professional Women Association (JBPWA), which provided material support for women in the immediate aftermath of the earthquake, later reported on the issues women encountered (Oguma and Akasaka 2015). The JBPWA asserted that the most urgent of these issues was the need to introduce gender considerations in the management of refugee shelters. It was mostly men, for example, charged with

managing the refugee shelters erected in areas affected by the Earthquake. Any specific instance in which managers accounted for women's safety were barely discernible, and the JBPWA judged a perspective that might perceive those aspects potentially threatening to women to be lacking. With all the beds arranged in an open area, for example, women had to sleep, breastfeed, and change clothes in a space shared with unfamiliar men. In many cases, such experiences were traumatic.

The problems associated with the management of the refugee shelters even escalated into sexual violence. On March 8, 2021, to commemorate "International Women's Day" and observe the tenth anniversary of the Great East Japan Earthquake, NHK broadcast a documentary, "The Truth of Voices Buried for Twenty-five Years: Sexual Violence amid Disaster" (*Uzumoreta koe 25-nen no shinjitsu: saigaiji no sei bōryoku*). The program presented the untold stories of women who had been the victims of severe abuse by family members or sexual violence during times of disaster since the Hanshin earthquake on January 17, 1995. Many women who lost their husbands and fathers in the earthquakes were raped or molested by refugee shelter staff members. There were also cases of "extortionate sexual violence," in which sex was demanded in exchange for recovery-related material support. One woman related the following account: "I was sexually assaulted by several men. I couldn't say a word to anyone for fear they would kill me, toss my body in the sea, and just say I died in the tsunami." According to another report analyzing the consultations of more than 360,000 women between 2013 and 2018 with the "Companion Hotline," a call-in counseling service for women, more than 50 percent of the consultations with women from the three prefectures affected by the Great East Japan Earthquake (Iwate, Miyagi, Fukushima) pertained to victims of sexual violence. About 40 percent of the consultations were with women in their twenties and teenage girls (*Ashita e tsunageyō* 2020).

Structural gender inequality was also prevalent in the recovery process. Even though women in the disaster areas contributed considerably to the recovery process, their perspectives were not accordingly reflected in disaster prevention, disaster response, or disaster recovery arrangements. While the male-dominated task of clearing away wreckage in the streets, homes, and buildings was remunerated, tasks carried out mainly by women, such as cleaning, preparing and serving food, and watching children at the refuge shelters, was treated as "volunteer work." Women who lost family members in the disaster needed facilities to help with looking after their children or elderly parents in order to seek out employment, but such relief could hardly be found (Oguma and Akasaka 2015).

A gender perspective was also severely lacking in disaster prevention. Members of local-government disaster prevention committees, decision makers in the process before and after the disaster, and local reporters covering the disaster were mostly men (Ökura 2019). According to a 2016 report of the Gender Equality Bureau Cabinet Office (Naikakufu Danjo Kyödō Sankakukyoku), among Japan's forty-seven prefectural governments, the proportion of women among the members of disaster prevention committees, excluding those of Tottori, Shimane, and Tokushima Prefectures, was less than 20 percent, and 30 percent of the local government committees featured a proportion of women less than 10 percent (Naikakufu Danjo Kyödō Sankakukyoku 2016). The overwhelming presence of men in disaster prevention committees, disaster response, recovery, and media reporting plausibly led to a gender bias in the disaster prevention and recovery processes.

Just as women's voices were inadequately reflected in determining policy and forming public opinion related to disaster prevention and recovery, so were they in the opinion surveys of disaster victims carried out by the national and local governments. When such surveys take the household as their unit of analysis, it is usually husbands or fathers that speak representatively. Thus, the underrepresentation of women in disaster situations leads to severe gender inequality in which women's voices are further insufficiently reflected after the disaster.

Unsurprisingly, women's exclusion and vulnerable status in a disaster situation were not something that newly emerged with the Great East Japan Earthquake and Fukushima nuclear disaster. The issue of structural exclusion and discrimination amid disaster was closely related to existing gender inequality pervasive within Japanese society. According to the 2021 World Economic Forum's Global Gender Gap Report, Japan ranked 120th among 156 countries in terms of gender equality (WEF 2021). Breaking down Japan's gender disparity, it was defined by inequality in the realms of politics (147th) and the economy (117th) more than education (ninety-second) or health (sixty-fifth). In other words, Japan's gender status disparity was particularly pronounced in the public sphere. The Earthquake and Fukushima nuclear disaster occurred against this socio-structural background, not only inflicting great harm on women, already more socially and economically vulnerable, but also serving to waste "women's potential as source of resilience" (Enarson and Chakrabarti 2009, xii).

Yet women did not just passively accept this political and social atmosphere consistently marginalizing and trivializing their perspective. As evident in the activities of the aforementioned JBPWA and those of various women's

organizations that publicized the urgency of operating a post-disaster sexual violence council center, women's efforts to overcome the disaster were dynamic and diverse, just as they had been in the past. In *Creating Women's Disaster Studies* (*Saigai josei gaku o tsukuru*), published in Japan in February 2021 (Asano and Tendō 2021) to mark ten years since the Great East Japan Earthquake, scholars sought to explain why the issues of violence against, and the excessive burdening of women amid disaster, have yet to be remedied in Japanese society despite repeated experiences of disaster, arguing for a theory and philosophy of disasters that specifically incorporate a female perspective. The book's editors Tendō Mutsuko and Asano Fumie, also members of local disaster prevention committees, lucidly articulate the experience of female disaster victims across a range of disasters, from the Hanshin earthquake (1995) to the Tōhoku (2011) and Kumamoto (2016) earthquakes, emphasizing the necessity of better incorporating women's perspectives in disaster recovery and prevention.

Women researchers, journalists, and others concerned with women and disasters have steadily strived to speak out since the Earthquake and Fukushima nuclear disaster. In the current study, I focus on one such voice, relative to the context of the radiation-measurement work carried out by women residing in Fukushima, as this form of citizen science indicates the possibility of a public imagining of an alternative mode of living amid disaster. Here, I understand "citizen science" in a general sense as a "scientific enterprises carried out by citizens" (Kim Chi-yōn 2018). Instead of regarding this practice of citizen science as a mere technical or rational cognitive activity, I explore how it induces new relationships and solidarity between human beings, material things, and institutions, how it expands the horizon of the imaginary, and how it works to weave together the lives of participants.

## After Nuclear Disaster: In the Place Where the Lines of Life Have Been Cut

In February 2018, as the Tokyo Olympics approached, most of the communities within the vicinity of the Fukushima Daiichi Nuclear Power Plant began to cast off their "evacuation area" or "return not recommended" statuses, and the Japanese Rail Group (JR) Jōban line linking Tokyo to Sendai, the urban hub of the Tōhoku area, reopened services to all but a few areas close to the power plant. In this context, I boarded the Jōban-line train bound for Namie-machi to carry out a preliminary survey of the Fukushima area. With just two passengers on board, the train passed by Iwakiōta and Odaka, both in Futaba-gun, and

then sped along a coastline engulfed in white smoke billowing from the Tohoku Electric Power (Tōhoku Denryoku)'s thermoelectric power plant. Soon afterward, the train came to a halt at Namie-machi Station, previously designated a "return not recommended" sector, where I disembarked. The area was as silent and still as a photograph. A corroded stele protruded from behind the dilapidated traffic lights of the station plaza. Amid the abandoned shops, a large truck ferried stones for constructing the embankment. The village was dotted with the red of rusted traffic lights and black of flexible containers brimming with decontamination waste, bereft of signs of life. In this place, where the myriad elements composing the "world of life"—traces of breath, sounds, colors, smells, thoughts, actions, and matter—are entangled as "lines" in the flow of time (Ingold 2015), the only things apparent now were the heavy truck mobilized for the embankment construction and a single station attendant. As I made eye contact with the attendant, he kindly informed me it would be better to leave on the train I had arrived on when it departed, since the next train to take me "away from here" would not arrive for a few hours.

Fukushima residents did not have "the time they ought to have had" following the nuclear disaster (Mutō 2021). Even as the government called for recovery and revival, the connective tissue of family and neighbors and affordable living enabled by the bounty of surrounding gardens, rice fields, and forests could no longer be taken for granted. Things once "ordinary" or "common" were now a matter of arduous labor to "revive" in soil impervious to decontamination. This place, in which the lines of life had been cut, was filled with uncertainty and worry over harmful radiation.

According to government statistics arrived at through radiation-measurement facilities installed in decontaminated areas, radiation levels did not exceed "permissible" levels. However, areas outside the government's decontamination efforts (forests, the outskirts of paddy fields, etc.) still make up a vast territory. Despite the national and local governments' rapid response and large-scale economic support following the Fukushima nuclear disaster, the problem of radiation contamination remains as important as ever for residents, both those who have returned and those who have yet to return. Consider, for example, the discharge of contaminated water from the nuclear power plant, currently the biggest issue in Japan. Tokyo Electric Power Company Holdings (TEPCO) has stated that "it will take forty years to discharge [the contaminated water] if it is diluted by a factor forty times [greater than now]," but this estimate pertains only to the amount stored in the contaminated water storage tank. The frozen soil wall inserted as a barrier between the groundwater and the contaminated reactor has repeatedly failed, and the amount of contaminated water has



continually increased. Recently it was also revealed that radiation leaking from the reactor core has been much higher than initially expected (Pak Hyöng-jun. 2021). Even the Atomic Energy Society of Japan (AESJ), which has displayed the most conservative position regarding the radiation danger of the Fukushima nuclear disaster, estimated that “the decommissioning of the Fukushima nuclear power plant reactor will take at least 100 to 300 years” (Fukushima Daiichi Genshiryoku Hatsudensho Hairo Kentō linkai 2020).

The Japanese government has largely failed to garner public trust in its disclosure of information regarding radiation leaks in the wake of the Fukushima nuclear disaster. Critics have pointed out that the sample sizes of government surveys are inadequate and that its standards for judging safe levels of radiation fail to satisfactorily reflect the variation of actual diets (Kim In-a 2015). Considering that the imperceptible risks of radiation exposure have extended beyond Fukushima to significantly impact people and their diets as far away as Tokyo, 300 kilometers away, mothers raising children in Fukushima cannot but be all the more anxious: “Did I do the right thing in remaining with my child in Fukushima?” “Will it be alright to hang the laundry to dry outside?” “Is it safe for the children to play in the sand of the playground in the nursery yard?” “Is it okay to swim in the sea?” According to a 2015 survey of the “Fukushima Children’s Health Project” (*Fukushima Kodomo Kenkō Purojekuto*), one out of two mothers in Fukushima reported still experiencing “anxiety about childrearing” (Fukushima Kodomo Kenkō Purojekuto 2015).

Distrust of government-published radiation-measurement figures generated diverse citizen-led radiation-measurement activities (Fuse 2016; Kimura 2016). In Iwaki, not designated an evacuation area but just twenty kilometers south of the Fukushima Daiichi Nuclear Power Plant, the sense of crisis over radiation contamination has been extremely intense. Residents procured their own radiation-measurement equipment and various citizen organizations formed with the express purpose of measuring radiation levels (Fuse 2016). In the current study, I focus on one of these citizen organizations, namely, TARACHINE (Mothers’ Radiation Lab Fukushima; hereafter TARACHINE).

### **TARACHINE (NPO Mothers’ Radiation Lab Fukushima): Radiation Measurement and Expanding the World of Life**

According to Marilyn Strathern (2004, xvi), anthropological analysis is essentially an effort to create “scale,” that is, “the organization of perspectives on objects of knowledge and enquiry,” which shifts in the transition between

differing perspectives regarding a phenomenon. What is particularly notable about “scale,” in her view, is its distinguishability from an analytical framework or methodological tool. Scale is that very thing through which people sense, construct, and expand the world. As E. Summerson Carr and Michael Lempert (2016) describe, when people talk about specific objects or phenomena, they sense the diversity and complexity of the world as they expand or shrink it by associating the object of their concern with comparable phenomena and arranging its properties (height, weight, length, circumference, frequency, speed, structural integrity, etc.). Through the acts of measurement and analysis, people categorize, distinguish, and hierarchically structure the relative positions of other people, material objects, and their properties. In this process, they do not simply yield to the influence of predetermined scales but rather create, develop, and construct new and differently oriented perspectives of measurement. In this sense, “scaling,” as an act of measurement, is essentially relational and comparative, as well as a constitutive activity expanding or shrinking the world (Carr and Lempert 2016, 3-4). It is in this context that historian and anthropologist Gabrielle Hecht (2018) emphasizes the need for reflexivity regarding scale-related methodologies and narratives, as scale is a political argument just as much as it is an analytical category. Since scale is not just about size, she argues, but also categories and explicit orientations; it is political, determining how we position ourselves and material objects and permitting or restricting the scope of their comparative consideration. In sum, then, measuring the scale of a tangible or intangible phenomenon is not a passive act involving mere dimensional descriptions based on predetermined measures; it is a necessary activity for social actors, who seek to organize, interpret, and orient their world, as well as a constitutive, dynamic, and essentially pragmatic process (Carr and Lempert 2016, 3).

The work of scale involved in determining radiation levels in Fukushima following the nuclear disaster quickly merged with the efforts to narrate causes, culpability, and political arguments related to the disaster. Radiation-measurement figures were more than just an abstract number; they imposed the bounds of people’s living spaces, served as the very basis for their activities and movements, and formed the basic raw material for debating and assessing the impact of and responsibility for the disaster. In this section, I explore the radiation-measurement activities carried out by women in Fukushima following the nuclear disaster. I view these activities in terms of how they allowed the women to relate and connect with their world of life as well as in terms of how they constituted the work of scale, creating a common sense about the world and expanding the possibility for life.

The TARACHINE radiation-measurement lab was established in Iwaki in November 2011. The mothers with young children initially founded the lab with the simple objective of ensuring food safety. TARACHINE itself was not particularly special; hundreds of such radiation-measurement labs sprung up all over Japan immediately after the Great East Japan Earthquake. Whereas many of these labs ceased activities as time went on, however, TARACHINE has persisted. The lab has twelve paid staff members, some of whom are doctors, and is supported by many regular and intermittent volunteers. Without government funding, the lab persists mostly through donations from individuals and organizations both in Japan and overseas, making up about 90 percent of its finances, as well as membership fees (there are about seventy paying members). TARACHINE's radiation-measurement data is recognized by TEPCO and the Fukushima Prefecture government and trusted by local residents.

TARACHINE was founded on the following objectives: "healthier living and a better environment for anxious people coping with pervasive harmful radiation caused by the nuclear power plant disaster" and "confirming exposure to radiation together with local residents and mending the unprecedented destruction of nature." Considering these objectives—seeking a "healthier living" and endeavoring to "mend the unprecedented destruction of nature"—TARACHINE's activities appear all the more remarkable. They do not consist of physically treating victims of radiation exposure or decontaminating land and buildings, as one might presume, but the *measurement* of radiation levels. In other words, this is the work of scale.

TARACHINE's activities are diverse, but they all involve the measurement of radiation levels. Some examples include the following: measuring the radioactivity of food and sharing the data with local residents by request; measuring internal radiation exposure resulting from diet, work, or other aspects of living and sharing the data with residents by request; proactive sharing of data deemed to be highly significant for public safety and petitioning for social and administrative measures; sharing easily accessible and informative data with the public regarding prevailing radiation levels; working to disseminate radiation-measurement know-how allowing residents to properly manage equipment and carry out measurements with ease; collaborating with scientific and medical professionals to ascertain the facts related to radiation exposure and accumulate radiation-measurement-related research, training, and medical opinions and knowledge; and collaborating with privately managed radiation-measurement facilities to attain and share information regarding the broader radiation-exposure situation.

TARACHINE's radiation-measurement activities have become more elaborate and diverse over time. When the lab was founded in 2011, analyses mainly targeted radionuclides contained in human bodies, food, and soil detectable through relatively simple equipment, such as cesium 147, cesium 134, and potassium 40. As the lab's activities have become known both at home and abroad and donations increased, they expanded from simple sample testing to those requiring far more specialized and complex equipment and technology. Measuring radiation levels not only in food, plants, and animals but also human bodies then became possible. In 2013, the lab began the Children's Thyroid Screening Project. In 2015, it began the Ocean Survey Project to monitor how much and how long radioactive substances such as tritium discharged along with contaminated water from the Fukushima nuclear power plant will affect the ocean, an issue which is also currently a concern in Korea. As the Ocean Survey Project is not a simple undertaking, with only full-time TARACHINE staff qualified to participate, it is carried out every two months in collaboration with Suzuki Yuzuru, professor emeritus of the Fisheries Laboratory in the Graduate School of Agricultural and Life Sciences, University of Tokyo.

TARACHINE's radiation-measurement activities incorporated not only samples collected by members themselves but also those independently commissioned by citizens. In 2018, for example, TARACHINE accepted about 100 commissioned samples per month. These objects consisted not just of various foods but also all sorts of objects children had contact with in their daily lives, including dirt from playgrounds or kindergarten yards and grass and tree branches from parks. Some patrons even requested analyses of the remains of deceased loved ones, curious to discover whether their deaths were connected to radiation contamination or perhaps also to gather evidence for a lawsuit.

Thus, TARACHINE's activities fundamentally consisted of measuring radiation levels in people and the objects that constituted the surroundings of their daily lives and organizing and sharing this data with the public. Members regularly posted the data, pertaining both to those samples they collected and those submitted by local residents, on its homepage along with detailed explanations. When I visited TARACHINE and asked Director Suzuki Kaori, who introduced me to the radiation-measurement lab, health clinic, and other facilities of the organization, whether the results of its measurements were different from those of the government, she answered with a smile, "No, they aren't." Indeed, she mused about how strange it would be if TARACHINE and the government's respective measurements were different given similar locations and samples. She added, however, that TARACHINE's measurements pertained to places and objects not routinely considered by the government or TEPCO.

TARACHINE provided unrestricted access to radiation-measurement figures regarding various objects encountered by women in their worlds of life, allowing them to adjust their distance from and relationships with these material objects. The radiation-measurement figures informed women of whether they could feed certain foods or drinks to their families or allow them to touch or make contact with certain objects. Furthermore, they allowed women to judge whether to accept warnings or political instructions about radiation exposure issued by the government and TEPCO.

Notably, Director Suzuki emphasized that the reason for measuring radiation levels despite the results differing little from those of the government had to do with TARACHINE's identity as an organization. This was not only a facility endowed with radiation-measurement and medical equipment. It was also a place where one could "speak freely" about radiation.

Our organization is a place where one can talk freely about radiation. We carry out radiation measurement, conduct tests, perform diagnoses, offer counseling, and provide explanations. We also create networks. ... Regarding radiation and the like, this is a place where one can safely say or ask anything, connect with other places if needed, and find explanations. It is important that people can come in and talk freely. [Local] people are constrained in talking about radiation. They are reluctant to talk about it since it feels like doing so won't change anything or allow them to do something about it. Due to this reluctance, however, husbands and wives develop differences of opinion over how to raise the children and become more stressed. People have differing understandings and differing views of how to cope. Radiation is invisible, intangible, and odorless. It is imperceptible without radiation measurement. For this reason, it can be something that you just ignore. Nobody knows [it's there]. If you ignore it [nobody knows it's there]. A mind is the same. A mind can have wounds even though imperceptible. And such wounds are subtle and complex. (Interview with TARACHINE director Suzuki Kaori, February 19, 2018)

In explaining the significance of TARACHINE's radiation measurements, Director Suzuki unexpectedly emphasized the importance of "mind" and "talk" rather than the readings themselves. In her explanation, "mind" was something invisible, intangible, and odorless, just like radiation, which is undetectable without measurement; it can be ignored even though it is problematic. Therefore, just as radiation must be revealed through measurement, one's mind must be revealed through "talking"

Here, Carr and Lempert's (2016) notion of "scaling" is relevant once again. "Scaling" refers to the work of organizing a perspective of a phenomenon and of sensing and expanding the world. As an example of this work in action, they draw upon a passage from Herman Melville's *Moby-Dick*. The "white whale"

Moby-Dick, after whom the novel is titled, is terrifying and massive, even compared to other sperm whales. He is also nasty and cunning, having killed or maimed countless whalers, and is seemingly immune to their harpoons. Of course, he also bites off the leg of the book's protagonist Captain Ahab. The passage that Carr and Lempert specifically refer to is that in which the narrator Ishmael attempts to convey the "size of the whale," with only its bones remaining, to an audience of villagers who have never seen or even imagined such an enormous sperm whale. To communicate the creature's magnitude, Ishmael begins by reciting elaborate mathematical quantities and the authoritative testimony of a marine specialist, but he soon turns to the accounts of those more accessible to the audience, complemented by moving analogies and familiar metaphors like the population of the village and the weight of a human being. What Ishmael endeavors to convey is not just the physical enormity of Moby-Dick but also the struggle and know-how of the whalers who fought to catch him. In other words, what he is trying to describe is the "profundity" of whaling. Ishmael's depiction of the whaler's struggles, experiences, and feelings creates a common sense for the audience through measurements accompanied by various metaphors and stories—that is, through the work of scaling the whale. A common imaginary of the whale Moby-Dick thus comes into being. It is within this common sense imaginary that the audience comes to intuit the immense work and scale of whaling.

The rough, nasty, and seemingly uncatchable sperm whale Moby-Dick is a source of great fear and anxiety for the whalers. Between those who have directly encountered the whale and those who have not, however, the disparity in the sense of the enormity of the creature and the profundity of its temper is unimaginably vast. To bridge this gap, Ishmael relies on the work of scale, drawing on various measurements and metaphors. Thus, Ishmael's example shows how the work of scale consists of a certain effort and mode of communication to create a commonsense notion of the world in a world of difference. This is much like the work of TARACHINE, which, through radiation-measurement activities, endeavors to reconcile the greatly differing senses of the world among those who have remained in Fukushima as well as between those who have remained and those who left it behind. In this respect, the work of scale conducted in Fukushima has also helped to "spawn a sense of intimacy and an ethic of interrelatedness" (Carr and Fisher 2016, 136). At the very least, TARACHINE's radiation-measurement activities have enabled those continuing to live in Fukushima since the disaster to express their heretofore unutterable inner thoughts and feelings and contributed to the process of considering how to sustain the relationship between people and their sur-

roundings.

The “minds” of Fukushima residents following the March 2011 nuclear disaster were hidden from view, but they nonetheless induced complex and subtle tension and conflict. Studies have reported on the diverse effects of the Fukushima disaster on families. Differing perceptions over radiation risks, determining whether to restrict the children’s playing outside, whether to change residences, or even what to eat, have led to conflict between spouses and between in-laws and even family separations (Söng Wön-chöl 2018, 241). Despite such conflict and tension, residents have had little more than the official figures relative to rates of radiation exposure deemed permissible by the government, at twenty millisieverts per year and 0.23 microsieverts per hour, to judge the safety of the Fukushima area. Radiation measurements easily accessible in real-time anywhere in Fukushima have been below the institutionalized rate of 0.23 microsieverts per hour. It seems this alone is supposed to make people feel safe.

Notwithstanding the problem of radiation contamination, most Fukushima residents have been unable to leave for want of a sustainable livelihood or other economic factors. The work of decontamination or decommissioning the reactor was dangerous but also relatively lucrative, drawing in many male Fukushima residents. Many husbands and fathers who disregarded the dangers of radiation contamination stayed in the area to take advantage of the chance to gain additional income. In the meantime, leaving Fukushima or speaking of the downsides of remaining came to be “frowned upon.” So, even though the presence of radiation was well known, resignation became commonplace.

Under these circumstances, it was difficult to speak out regarding concerns about radiation contamination, as exemplified in the attacks against Team Mamabeku (Iwaki no Shoki Hibaku o Tsuikyū Suru Mama no Kai), a women’s organization that publicly sought out and questioned the official responses of the local government regarding initial and internal radiation exposure discovered among children in Iwaki. Formed in February 2013, the organization frequently publicized the difficulties and concerns of mothers with children regarding radiation contamination in Fukushima not only domestically, through NHK and other networks, but also overseas in France, the United Kingdom, the United States, and so forth. With each of these broadcasts, however, Team Mamabeku was criticized for “harming” Fukushima’s agricultural sector. In the most serious such incident, some members were approached outside their homes and threatened. In this atmosphere, there were many cases in which mothers commissioned samples of their children’s playgrounds for radiation analysis without revealing the results to the nursery schools or kindergartens



where they were located. Mothers rather worried over the potential harm to these places if it became known they were contaminated to a degree higher than the official figures and had to close or conduct the costly work of decontamination. Being responsible for most of the care work in the family and in wider society, many of these women cannot but be sensitive to the issue of internal radiation exposure, but they have been easily stigmatized as selfish for spreading “rumors,” or even “unpatriotic” citizens for the very act of verbally expressing such suspicion or anxiety. At the village level, conveying concerns about local pollution is regarded as an “insult” to a community run mostly by middle-aged men (Yi Yun-suk 2021).

As much as they were the victims of significant harm in the Fukushima nuclear disaster, women have now become the victims of a “second disaster” in terms of their subjection to hatred and criticism. As evident in the derogatory phrase, “We don’t need Fukushima daughters-in-law,” on the one hand, Fukushima women have been treated as “potential radioactive contaminants that may reproduce abnormal offspring,” while on the other, they are criticized as irrational, selfish “hysterics” who “complain” and “betray community efforts at revival.” Women’s fears about the risks of radiation exposure, which are sure to be long-lasting, have not received societal support. As their actions and comments became the objects of open criticism in public spaces, women internalized the experience of being systematically excluded from decision-making processes, only to become ever more isolated and suppressed.

In this context, TARACHINE’s radiation-measurement activities also constituted an attempt to break free of the oppressive environment excluding women’s voices and reconstruct the various objects, people, places, and spaces linking women’s lives together from a woman’s point of view. Through radiation measurements, the women created a new sense of the various objects they had contact with in their world of life, creating a perspective to reorganize their world of life in the manner that Strathern (2004) describes. TARACHINE explained the properties and significances of local residents’ various commissioned objects by measuring and analyzing them, even if they were irrelevant as “reference points” or “cases for comparison” for the standardized radiation-measurement activities of the government or TEPCO. Based on the data collected from these activities, TARACHINE members were able to organize, interpret, orient, and act in their world. In this regard, their radiation-measurement activities constituted a dynamic and essentially pragmatic act of talking to people about their shared worlds of life (Carr and Lempert 2016, 3).

In an atmosphere in which it was difficult to freely express concern over radiation contamination, TARACHINE established itself as a place where one



could talk about anything related to the Fukushima nuclear disaster. Above all else, this was a place in which one could discover the radiation levels in things they were curious about—things they encountered in their daily lives such as food, playground soil, and seawater—and even individually commission samples to be analyzed. Furthermore, this was also a place in which one could discuss radiation measurements to one's heart's content, without fear of being labelled "selfish," mocked as "paranoid," or condemned for spreading rumors. TARACHINE was a place allowing women to comfortably talk in a local atmosphere and connect with one another over shared concerns and anxieties.

Of course, TARACHINE was not the only facility sharing radiation measurements. Data published by TEPCO and the Ministry of Environment, however, was little more than that: a set of numbers divorced from any significance for one's world of life. It did not tell people how to raise their children, whether or not to move, what to eat, or what toys to play with. TARACHINE thus went beyond the mere "measurement" of invisible, intangible, and odorless radiation; it was also a place where people could "talk" about their invisible, intangible, and odorless "minds." TARACHINE invites professionals in the fields of medicine and science from in and around Fukushima Prefecture, for example, to give lectures on the effects of radiation exposure. The organization has even hosted a gathering with radiation victims from Belarus.

People don't really know how it feels unless they have been afflicted themselves. Radiation is invisible, intangible, and odorless, so they don't perceive it. It's the same as not perceiving a mind. When the Belarusians visited, in talking to them I felt just how much a similar position creates a common sensibility. That's why it's so important to have similar experiences and to meet with colleagues. (Interview with TARACHINE director Suzuki Kaori, February 19, 2018)

As Director Suzuki describes, TARACHINE was a place for "measuring, testing, diagnosing, providing counseling for, and explaining" radiation and for networking. Local residents referenced, cited, and used TARACHINE's radiation-measurement data in interpreting their experiences and the world, orienting their lives, and organizing and conducting their activities. Through the data, moreover, they were able to "talk" with one another and create a "common sense" while making connections with events of and people from different places, such as Belarus. The radiation-measurement activities carried out by the women of TARACHINE in the wake of the Fukushima nuclear disaster thus served as a means of connecting and relating to the world in which they lived and as the work of scale constructing a common sense and expanding the possibility of life in this world. The assorted anxieties, suspicions, in-

difference, ignorance, and hopes and intentions related to the possibility of life coloring the hearts and minds of those who continue to reside in Fukushima are not simply given. They are elaborate creations made in the comparison, differentiation, and categorization of the various and complex measurements arrived at through such work of scale.

## Solidarity for Life after a Disaster

Women anxious and isolated following the Fukushima nuclear disaster spoke out on the internet and organized various activities to connect with one another. In this regard, the magazine *Mama Rebo* (Mom's revolution) played a pivotal role in representing the voices of women from all walks of life who participated in the post-disaster trial over the status of evacuations, investigation of radiation exposure, and disaster responses (Yi Yun-suk 2021).

Utsunomiya University's Shimizu Nanako also played a part in connecting these voices, compiling the testimonies of women who had evacuated Fukushima Prefecture for Tochigi Prefecture following the nuclear disaster. She reported that the derogatory phrase "we don't need Fukushima daughters-in-law" represented only a fraction of the attacks these women were exposed to online and face to face. It was not enough that female evacuees had experienced tremendous loss in the disaster itself. Now, they were also subjected to sexual discrimination and oppression, excluded from decision-making processes in their families and communities, and mired in deep feelings of isolation. Explaining why she decided to compile these testimonies in the *Mainichi Newspaper* (*Mainichi shinbun*), Shimizu stated the following:

Having majored in international relations theory, I have studied war and peace. Victims of war or civil war generally do not actively seek to speak out about their experiences. They rather strive to live on their own. Particularly, victims of sexual assault fear discrimination or stigmatization. Meanwhile, the state has little interest in making a record of uncomfortable facts, sometimes even acting to cover them up. The Fukushima nuclear power plant was a national government project. I thought that the voices of the victims of the nuclear disaster should be properly recorded so that something like this doesn't happen again. (Makino 2021)

Shimizu describes the suppression of the voices of women who fled Fukushima following the nuclear disaster as analogous to a war or civil war situation, well conveying these women's feelings of isolation and dejection. Shimizu carried out her work in the belief that such experiences need to be

documented, connected, and conveyed to the rest of Japan and to future generations. In that case, most important would be the matter of receiving, resonating, and amplifying these voices to ensure they are heard far and wide.

How might this be accomplished? TEPCO has unfailingly emphasized that the Fukushima nuclear disaster was an “exceptional incident” caused by an “unforeseen” earthquake and tsunami and that residents’ concerns over the risks of radiation exposure are manageable and resolvable (Oh Eunjeong 2020). Such pronouncements are reminiscent of those made by TEPCO in 1986 amid the Chernobyl nuclear disaster. Although shocking to the rest of the world, TEPCO asserted this event was due to a flaw in the outdated technology of the Soviet Union in the form of the graphite moderated reactor and that it was an “exceptional incident” that could not happen in the nuclear power plants of advanced countries like Japan. By framing the Fukushima nuclear disaster also as an “exceptional incident,” TEPCO portrayed it as a chance occurrence caused by an earthquake and tsunami—unpredictable and unimaginable events—ruling out structural problems in the nuclear power industry and restricting the scope of the danger to a specific area, that is, Fukushima and the surrounding area.

Yet accidents have occurred frequently amid the development of the global nuclear power industry since the mid-twentieth century, suggesting that the Fukushima nuclear disaster was in fact not a single, isolated “exceptional incident.” In a corner of the TARACHINE radiation lab, there was a white plastic container filled with more than ten liters of seawater collected off the coast of Sellafield, England. Brought over for the sake of comparison with contaminated seawater off the coast of Fukushima, this seawater was an important object in expanding the scale of the Fukushima disaster from a localized “exceptional incident,” as articulated by TEPCO, to a global event.

The nuclear power region in Sellafield, adjacent to the Irish Sea in Northwest England, provides a representative case of radiation contamination. The complex drew international criticism in the 1980s when it was revealed it had been secretly releasing radioactive waste into the sea since 1965 (Cho Ki-wŏn 2014). More than just a yardstick for determining the degree of seawater contamination from the Fukushima disaster, this Sellafield seawater stored at TARACHINE served to frame the Fukushima nuclear disaster not as an “exceptional incident” but a stain on the historical landscape of the twentieth-century nuclear technology and power industry. In other words, the Sellafield seawater is a form of “vibrant matter” (Bennett 2010) allowing the women of TARACHINE to forge a more direct and sustainable relationship between Fukushima and local residents and objects located on the opposite side of the

world.

In this context, TARACHINE's scientific work of scale in the form of radiation measurement is a project for forging networks and a political act in and of itself. This shows how the scientific activity of radiation measurement transcends the dogmatic distinction between objective and neutral and irrational and unreasonable activities: In and of itself, it is a form of social and political action. Beyond the distinction between individual things and public things, moreover, it is a connective and world-constituting action. In sum, TARACHINE's radiation-measurement activities are an attempt to imagine and pursue the possibility of a new form of public life, generating a worldview by which local women may sense and experience the world from their own perspective.

Aya Hirata Kimura (2016) interprets Fukushima women's radiation-measurement activities as a story of resistance to neoliberal ideology and the traditional patriarchic order. The meaning of these activities, she argues, does not lie in the women's practice of citizen science in a disaster area itself but in the narrative and imaginative power of their "story of resistance" to Japan's ruling system, which depended on nuclear energy for development. The attempt to link TARACHINE's activities with imaginaries of public life related to the activities of women in other regions reinterpreting the Fukushima nuclear disaster and the subsequent recovery efforts from the perspective of publicness. Fukushima Women Who Don't Need Nuclear Power (Genpatsu Iranai Fukushima no Onna tachi) is an important example of an organization that has joined together in solidarity with TARACHINE. Fukushima Women Who Don't Need Nuclear Power was founded by women in Fukushima City and Koriyama City, both in Fukushima Prefecture, following the "Action of 10,000,000 People to Bid Farewell to Nuclear Power" rally in support of shutting down the nuclear power industry held in Tokyo on September 19, 2011. Under the rallying cry of "making sure the Fukushima disaster was not in vain, fighting to the end, and never giving up," Fukushima Women Who Don't Need Nuclear Power organized its first rally on October 27 later that year, with 111 people gathering in front of the headquarters for the Ministry of Economy, Trade, and Industry. In the week-long protest, the demonstrators submitted the following four demands: the immediate shutdown of all nuclear power plants and decommissioning of all nuclear reactors; injunctions against reactivating any nuclear power plants currently shut down; the mobilization of state capabilities to immediately evacuate all children to safe areas and full compensation for all citizens already evacuated or expected to evacuate; and the repeal of the three "power supply" (*dengen*) laws enticing local governments with subsidies to construct nuclear

power plants and hindering local autonomy. Since its establishment, the organization has conducted diverse anti-nuclear power activities, including protests against the reactivation of nuclear power plants and legal action demanding compensation for children and decontamination workers. Since the first anniversary of the Fukushima nuclear disaster, the organization has gathered annually every March 11 for the “Gathering for Life on Earth without Nuclear Power.”

## Conclusion

Disasters undoubtedly destroy people's lives and communities. In societies devastated by disaster, however, new public relationships are formed and frames of solidarity constructed, perhaps even leading to long-term social and political change (Fritz 1961; Solnit 2012; Morris-Suzuki 2017). In the restoration of life after a disaster, public imaginaries that narrate how the individual, community, society, and the state should imagine and respond to disasters and formulate alternatives in the aftermath are of paramount importance. Considering this point, we might ask if the Fukushima nuclear disaster has engendered trends toward long-term social and political change, and the forming of new public relationships and frames of solidarity within Fukushima and Japan?

In a philosophical investigation regarding the “lines of life,” British ecological anthropologist Tim Ingold (2015) declares that in the world of life created by the intertwining wind, air, sky, earth, rivers, oceans, and forests, even if it becomes more elaborate and complex due to human knowledge and technology, all beings spontaneously fulfil the principle of mutual response, endowed with a fundamentally social character, by constantly responding to one another. The fact that all living things, including human beings, interact with one another and with the material world in living their lives is also relevant for Fukushima, where the world of life has fractured.

We are the souls of Tōhoku now quietly burning with wrath. ... We must imagine a world beyond convenient electricity. We must consider the fact that convenience and development are built upon discrimination and sacrifice. This is all the more so for nuclear power. Humanity is but a single being in the global village. Could any other rob its own kind of the future? I want to live as a being in harmony and congruence with this beautiful planet we call Earth. I want to use energy sparingly and lead a frugal but abundant and creative life. No one quite knows how to create a new, nuclear-free world. ... If the force propelling the reignition of nuclear power were a soaring vertical wall, then ours would be one

stretching horizontally into infinity. Gently take the hand of the person next to you now. Face each other and listen to each other's pain. Let us allow each other rage and tears. Let us spread the warmth of these hands across the nation and the world. No matter how heavy the burden each of us must carry or how harsh the road we must travel, let us not ignore but help each other and live peacefully and cheerfully. (Mutō 2011)

TARACHINE's radiation measurements—pertaining to rice, beans, potatoes, onions, radishes, bracken, apples, pears, soybean paste, tofu, beef, chicken, fish, shellfish, earth, sand, seawater, river water, tree branches, lumber, ashes, and workers who helped to shut down the Fukushima reactor and the bones of those who died doing so—allowed local women to adjust their and their children's relationships to the various objects and people they had contact with in their daily lives. In this place where people have to go on living, radiation measurements provide the resources for imagining the possible landscape. The meaning of these readings is not intrinsic but relational, allowing residents to dexterously adjust and organize their distance and relationships with other people and material objects, determining what is safe to touch and what is dangerous and what needs to be decontaminated and covered. Occasionally, this information has even developed into material for political arguments or a catalyst for social change.

In sum, radiation measurement here created the responses, connections, and solidarity that formed the basis for sustaining the lives of those who continued to reside in Fukushima following the nuclear disaster. Its significance, therefore, cannot be reduced to the domains of competing knowledge claims over radiation risks or scientific, techno-rational evaluation. Radiation measurement rather serves as a means for women forced to endure an uncertain and sustained disaster situation to relate and connect to their world of life. It effectively functions as work of scale creating a common sense about this world and expanding the possibility of life. This work of scale constitutes a manifestation of the politics of life and an ethic of solidarity, and a meaningful effort to change the relationships between human beings, material objects, and institutions.

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