ISSN: 2833-4353

Research Article

Archives of Epidemiology & Public Health Research

A Comparative Study of Minamata Disease Between inside and outside of Japan: With a Focus on Mercury Contamination in the Amazon

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Submitted: 2025, Apr 12; **Accepted:** 2025, May 16; **Published:** 2025, May 22

Citation: Yoshida, K. (2025). A Comparative Study of Minamata Disease Between inside and outside of Japan: With a Focus on Mercury Contamination in the Amazon. *Arch Epidemiol Pub Health Res, 4*(2), 01-08.

Abstract

Minamata Disease in Japan was one of the most notorious public nuisance cases in the 1960s and 70s, but is still ongoing "unfinished business" in terms of victims' protection even after several decades of struggles. The world standard of epidemiological causation has still been applied in limited cases. However, it has been pointed out in an international report that, in recent years, mercury contamination has decreased in countries in the Global North, except the Canadian Indigenous peoples' case, at the same time that it has increased in the Global South. In the Amazon, many Indigenous peoples, most prominently, the Munduruku people in Para state and the Yanomami people in Roraima state, suffer from Brazilian Minamata Disease due to different types of mercury contamination, as a typical case of global environmental injustice issues.

This paper discusses the comparative difference of Minamata Disease inside and outside Japan: In Japan, serious accumulated mercury contamination occurring in Shiranui Bay of Kyushu due to poisonous waste release by the large Chisso corporation was concentrated, while in the Amazon, contamination due to gold mining by ASGM (Artisanal Small Scale Gold Miners) has been much broader and more diffused. Thus, civil law damages litigation has historically worked despite some challenges in Japan, while it's practically impossible to stop numerous small scale gold mining operations by a judicial approach in the Amazon. Instead, administrative regulation under the Lula Administration contrasted to the Bolsonaro Administration might be an especially important means of amelioration, although still limited, considering the global demand for gold and related continuous gold mining activities. Minamata Disease symptoms among the Indigenous peoples along the Amazon are generally minor compared to the Japanese case, but they should also be examined from liberal standards that criticize traditional stringent standards such as the Hunter=Russell criteria. However, facing the worsening situation of mercury contamination, the challenges in the Global South are serious: The effective measures for local residents overall health are limited except for dietary education to avoid poisonous carnivorous fishes as opposed to herbivorous fishes. International assistance for providing clean water is also an imminent agenda.

Keywords: Mercury Contamination, Minamata Disease, Gold Mining, Global Environmental Injustice, Epidemiological Causation, Indigenous Peoples.

1. Introduction

In Japan, the debate over Minamata Disease due to mercury contamination has been dying down in Japan, even though the issue has not been resolved at all. Furthermore, outside Japan it has become a global health issue across the world despite the 2013 Minamata Convention [1]. According to an international environmental report, in recent years, mercury contamination has decreased in countries in the Global North, except the Canadian Indigenous peoples' case , at the same time that it has increased in the Global South [2,3].

Of late, mercury contamination in Latin America has become a hotly debated issue internationally [4]. Consequently, in this paper, I compare Minamata disease between Japan and Amazon area, especially Brazil. Against a backdrop of a Japanese experience of several decades since official recognition of Minamata Disease in the mid-1950s and its legacies including negative ones, this paper analyzes commonalities and differences of Minamata Disease situations inside and out Japan, with a comparative focus on mercury contamination in the Amazon.

2. Brief History of Japanese Minamata Disease

The history of Japanese tragic Minamata Disease struggles over

several decades has developed with judicial litigations and related administrative regulations and can be divided into four parts: (1) Mercury Accumulation by Waste Release by Chisso until the Kumamoto District Court decision of 1973; (2) Limited relief by the 1977 diagnostic standards; (3) gradual expansion by political settlements from 1995; (4) Judicial expansions by No More Minamata Decisions afterwards [5].

2.1. (1st Stage) Mercury Release Accumulation without any Regulation

Chisso Corp. established in the early 20th century in Minamata, the southernmost city in Kumamoto Prefecture, already started to release mercury for the production of acetaldehyde in the 1930s and increased release in the rapid economic growth era of postwar Japan. Shiranui Bay communities faced dying fish and cats, and seriously paralyzed Minamata mercury poisoning patients were finally officially acknowledged as Minamata Disease patients in the mid-1950s. As photographer Eugene Smith (1918~1978) revealed, victims and their communities were marginalized and discriminated against [6]. As explained later, Minamata Disease was caused by brain stem damage with multifarious symptoms due to methylmercury, especially through eating poisonous fish, because there were abundant fishing banks near Minamata City. Due to the longterm release of poisonous methylmercury waste from the chemical production factory in a limited area, methylmercury accumulation through the food chain occurred to unimaginable degrees and many people suffered serious illness and even death. Almost all fishermen surrouding Shiranui Bay caught poisonous fish at the Minamata Banks as the staple of their diet, and the sufferers and victims of Minamata Disease turned out to be geographically broader than first thought, as opposed to the administratively designated area by related legislation.

This is the background to the limited compensatory limitation alongside the acknowledgement problems stated later. Administrative response was unbelievably slow, as was often the case in company towns, with no movement for application of the related Food Sanitation Act of 1947. With no effective measures to stop contamination, Minamata Disease litigations both in Kumamoto and in Niigata were among four notorious public nuisance litigations in the heyday of Japan's rapid economic growth era of the 1960s and 70s [7].

The Kumamoto District Court decision of March 20th, 1973 was revolutionary, setting up a high standard of negligence, demanding even the plant closure and introducing epidemiological causation implicitly [8]. It admitted 16 to 18 million JPY monetary damages depending on the disease level. Shortly thereafter, in October 1973, a comprehensive victims' compensation statute, the Public Nuisance Health Damage Compensation Act, was legislated. At this stage, the ministerial standard of the Environmental Agency in August, 1971 for acknowledging Minamata Disease was considered broad enough.

2.2. (2nd Stage) Limited Relief by the 1977 Diagnostic Standard

However, the new Minamata Disease Diagnosis standard of 1977 issued by the Minamata Disease Identification Committee was stringent and limited the scope of victims' compensation. It required, as did the Hunter=Russell standard, all of ①mobility failure, ②balancing failure, ③concentric contraction of the visual field, ④hearing failure, in addition to simple neural paralysis. Dr. Tadao Tsubaki and Akihiro Igata who lead the Committee, argued that all those phenomena should coexist. However, nowadays, such conservative positions have been flatly criticized as nonsensical by Prof. Toshihide Tsuda, according to contemporary epidemiological arguments [9]. As a result of the comprehensive compensation statute being applied stringently, victims had to face ordeals, Masami Ogata's case being a good example (see, Figure 1) [10]. As former Finance Ministry Bureaucrat Hirohisa Fujii frankly confessed, this unreasonable situation was related to the limited budget for Minamata problems [11].

2.3. (3rd Stage) Gradual Expansion by Political Settlements after 1995

Tort law litigations to expand protection started globally in Japan in May, 1980 and in December, 1995 under the Murayama Administration, a political compromise settlement was made to provide ①2.6 million JPY to approximately 10,000 Minamata Disease patients regardless of their diagnostic acknowledgement, and ②60 million to 3.8 billion JPY to the victims' corporation. As a continuation, by the Special Statute of 2009, there were provisions of 2.1 million JPY to individuals, and further to related corporations.

Thus, 11,000+ victims, by the 1995 Settlement, and another 35,000+ victims, by the 2009 Special Statute, received some relief, compared to only 3000+ victims who had gotten compensated by the comprehensive statute of 1973. It should be noted, however, that there were only 1000+ people, and 3000+ people alive in each case, and the amount of their provisions was just a fraction of the amount they could have received in case of judicial damages litigations. Furthermore, the number of people protected was still limited: according to Attorney Mitsutoshi Hayakawa who plays the central role in the No More Minamata litigations mentioned later, only 10% of the real victims and survivors could receive some compensation,. In this sense, the negative legacy of the unreasonably stringent standard of 1977 still continues.

2.4. (4th Stage) Judicial Expansions by the No More Minamata Decisions and Related Problems

The judicial efforts made some progress to expand the 1977 standard. Both Japanese Supreme Court decisions of 2004 and 2013 rejected the 1977 administrative standard, stating that it was unscientific to deny identifying Minamata Disease in case of sensation paralysis [12].

Importantly in this connection, in 2005, the Shiranui Patients Association was established among non-acknowledged patients to file 'No More Minamata' lawsuits globally in Japan in order to broaden the scope of legislative protection. Another 3000+ patients got settlement in 2011 in Kumamoto, Tokyo and Osaka and other places, although in that case the level of protection was

similar to that of the 2009 Special Statute, which in turn was much lower than a judicial damages award. Thus, results have depended on patients' will, length of the remainder of their lives, and their remaining energies.

From the medical side, in addition to Prof. Tsuda's criticism of the 1977 standard from the genuine epidemiological causation perspective mentioned above (see, footnote 9), it should be noted that there was a comprehensive investigation of Shiranui Bay Minamata Disease patients in the broader base, spearheaded by Dr. Shigeru Takaoka in 2009. Therein, many symptoms of Minamata Disease, including minor ones such as forgetfulness, cramps, vision problems, joint power failure, dizziness, and ringing noise, have been identified [13]. Incredulously, the Japanese government and Chisso Corp. are still adamant in denying identification of Minamata Disease for unacknowledged Minamata Disease patients. Mainstream Japanese civil law and environmental law scholars, such as Prof. Tadashi Ohtsuka of Waseda University and others have oddly opined that a dual approach should be taken with regard to epidemiological causation, and that discrete traditional causation should also be required [14]. This stance matches with the negative position of the Japanese government and Chisso Corp. mentioned above and disfavors Minamata Disease patients whose reparations are still seriously needed. As has already been justly criticized by Professor Tsuda, Prof. Ohtsuka does not understand the 'Hume theorem', and thus the genuine meaning of epidemiological causation. This chaotic situation in Japan is reprehensible from world standards.

Even after Dr. Masazumi Harada's criticism of medical corruption among the Minamata Disease expert doctors since the 1950s and 1970s at latest, judicial improvement has sometimes stalled, stranded in legal academic chaos among Japanese environmental legal scholars for another generation since the 1990s [15]. In some sense, with incorrect understandings of additional requirements of 'damage' (i.e., Minamata Disease acknowledgement) and 'double causation', both the Japanese medical and legal academies have had collusive relationships with political and economic powers.

In this serious situation, the judiciary has chaotically been taking a "zigzag" moving-around confused position even in recent years: On the one hand, the Osaka District Court decision of September 27th, 2023, took a revolutionary position, admitting state and corporate joint liability for victims' protection with a correct understanding of epidemiological causation, awarding damages to all of 128 plaintiffs. The Kumamoto District Court decision of March 22nd, 2024, on the other hand, took a negative position by applying the statute of limitation with the odd interpretation of its starting point, although the Kumamoto Court admitted the possibility of protection outside of the 2009 Statute. The Niigata District Court decision of April 18th, 2024, took a middle course admitting the corporate liability for more than half of plaintiffs outside the 2009 Statute, by considering them Minamata Disease patients and by rejecting the statute of limitation arguments [16]. The Japanese legal academia as well as medical academia should realize responsibility for this stalemate and should take matters much more seriously. To improve this situation, global criticism according to world-standards and the related consciousness raising toward genuine understanding of epidemiological causation is essential.

3. Differences in Minamata Disease in Japan and in the Amazon

3.1. Preface: Globalization of Minamata Disease

The late Dr. Masazumi Harada already worked on the globalization of Minamata Disease and investigated mercury contamination in the Amazon, especially at Santarem with the late Dr. Branches in the 1990s [17]. Surprisingly, around 50 Japanese lawyers visited there when the Rio de Janeiro Summit was held in 1992. However, regrettably the joint collaborative research between Japan and Brazil has been interrupted since then, although research on mercury contamination itself has flourished in Brazil, unlike the situation in Japan [18].

Upon the request of the prominent scholar Prof. Paulo Basta of Fiocruz (the Oswald Cruz Foundation in Rio de Janeiro, Brazil), the author has decided to pursue this strand of research after a generation-long blank of joint research [19]. Coincidentally, to work on this issue, I visited the Amazon in Amapa State with Decio Yokota, an expert on this issue, in May, 2022, and joined Prof. Basta's workshop in a Munduruku Village to experience the Indigenous life along Tapajos River in Para State in March, 2023 [20]. In the Amazon, many Indigenous peoples, most prominently, the Munduruku people in Para State and the Yanomami people in Roraima State , suffer differently from Brazilian Minamata Disease due to mercury contamination, in what constitutes a typical case of global environmental injustice issues [21].

3.2. Difference of Minamata Disease between Inside and Outside of Japan

This section details the comparative difference of Minamata Disease between inside and outside Japan: In Japan, accumulated mercury contamination in Shiranui Bay of Kyushu due to poisonous waste release by the major corporation Chisso Co. was serious, while in the Amazon, contamination due to gold mining by ASGM (Artisanal Small-Scale Gold Miners) has been much broader and more diffused in terms of geographical space and methylmercury density. Thus, as was shown in the previous chapter, civil law damages litigation has historically worked remarkably despite some challenges in Japan, while it's practically impossible to stop numerous small-scale gold mining activities in the Amazon by a judicial approach. Instead, administrative regulation under the Lula Administration, as contrasted to the Bolsonaro Administration, might be especially important, although still limited, considering the continuing global demand for gold and related continuous gold mining activities [22].

In this way, there have been almost no judicial cases regarding mining in Latin America. But exceptionally there have been limited Free Trade Agreement international cases covered by the International Center for Settlement of Investment Disputes [23].

The dispute was between Canadian investors of mining companies and the Colombian government, which regulates the mining industry for environmental protection of Santurbán Páramo, around 500km north of Bogotá, near Bucaramanga. The tribunal in the Eco Oro Case (2021) was more sympathetic to the plaintiff's request for damages for their economic damage due to plant closure in general, while it has moved to stress the public policy of environmental protection in the Red Eagle Case (2024). Even though internationally well-known, we have to admit that these international law cases are only 'indirectly' related to gold mining. I doubt that they are helpful for our topic.

3.3. Features of Brazilian Minamata Disease

Minamata Disease symptoms among the Indigenous peoples along the Amazon are generally minor compared to the Japanese case. The affected Indigenous people the author met in the Amazon told me about their mercury poisoning symptoms such as forgetfulness; cramps and paralysis of their limbs; eye focus malfunction; occasional fainting; weakening grip power and migraine headache, etc [24]. But from a liberal standard that criticizes traditional stringent standards such as the Hunter=Russell criteria, these should also be considered symptoms [25].

To take another example, human hair mercury concentration is another measure to check Minamata Disease. Dr. Basta's team has already investigated mercury contamination among the Munduruku people along the Amazon by this method (see, Basta et al. (2021c)) and their standard is 6ppm, while the threshold for achnowledging the Minamata Disease in Japan established in 1991 was an unbeliebably high 50ppm, and is being harshly criticized nowadays [26]. In this way, there is nothing to learn from the negative legacy in Japan that has narrowed acknowledgement of the scope of Minamata Disease and has rather brought about numerous ordeals to Minamata Disease patients over many decades, as described in the previous chapter.

4. Concluding Remarks: Challenges and Prospective Solutions

However, facing the worsening situation of mercury contamination due to gold mining industry activities, the challenges in the Global South are serious: Effective measures that can be taken by Indigenous peoples in the Amazon for their overall health are limited to dietary education to avoid poisonous carnivorous fishes as opposed to herbivorous fishes [27,28]. For future possible litigations by the Indigenous peoples of Canada or in Latin America, a genuine understanding of epidemiological causations as opposed to the Japanese mainstream fake doctrine of binary causations (see, the previous chapter) is recommendable.

Until the 21st century, Indigenous peoples across the globe have been historically marginalized and discriminated against [29]. In the Amazon, in addition to climate injustice due to deforestation and related environmental degradation, Indigenous peoples are unfairly outstanding victims and sufferers of mercury contamination paradoxically, despite their environment-friendly religious animistic world view that is contrastable to Euro-American anthropocentrism. Facing their poverty, it has been pointed out that internal communal economic development projects such as Ms. Arlete Leal's establishing cooperatives for producing Indigenous soap in Amapa State, should be vital from a social solidarity economy perspective [30].

However, note should also be taken that formation of their basic infrastructure itself is one of their fundamental challenges in avoiding Minamata Disease. Nation-state based governmental support is meagre, and international assistance for improving their situation is additionally an imminent agenda. For example, during the author's week long stay at the Munduruku village (Sawre Muybu village) in March, 2023, I made a brief but impressive and unforgettable visit by a small ferry boat to Sawre Aboy village, one of the most contaminated areas in the Amazon, according to Prof. Paulo Basta's article [31]. I learned from the village master Mr. Jairo's ardent appeal that international assistance for providing clean drinkable water and for increasing ease of transportation to get their daily necessaries itself was also an imminent agenda (see, Figure 2) [32].

Frankly, such task is beyond my ability as an academic scholar, but I feel obligated to do my best to make networks towards this goal, including some negotiation to make requests for JICA's assistance to them [33]. We need to realize that this is exactly the forefront of global health issues and that international communities should make contributions, as part of 'global justice', 'climate justice', and 'Indigenous reparations', and at multi levels such as (i) the international level; (ii) the regional governments level; and (iii) the NGO level. There should be an academic network of related associations as a background to flourishing international global assistance for vulnerable peoples.

Lastly, in comparison to the Japanese situation, in the future when mercury contamination still aggravates conditions for the Indigenous population in the Amazon, medical support will be required and the related administrative comprehensive compensation statute like the 1973 legislation in Japan will be recommendable. In such a case, the Japanese negative legacy concerning acknowledgment should not be reiterated. Furthermore, if it is necessary, as for the epidemiological causation regarding Minamata disease, the chaotic Japanese situation mentioned before should not be modelled: genuine epidemiological theories in the United States should be widely applied in Latin American countries [34].

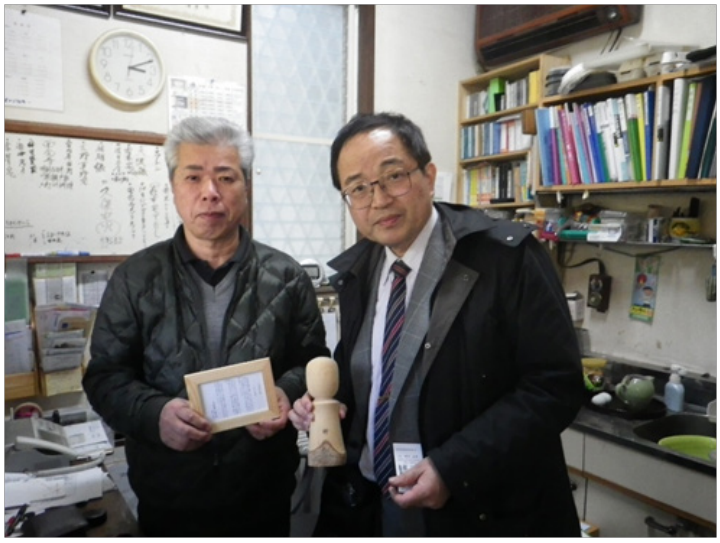

Figure 1: (with Mr. Masami Ogata, a Minamata disease patient who won the compensation lawsuit after many years (February, 2017) (at his house)

Figure 2: (with Muybu Village master Mr. Jairo (next to me) at the terrace commanding contaminated opaque Tapajos river) (Professor Basta at far left) (March 2023)

1. The Minamata Convention on Mercury was signed on October 10th, 2013, in Kumamoto, Japan and was effectuated in August 2017 to protect human health and the environment from anthropogenic mercury emissions and releases (Art. 1). As of February 2024, there are 128 signatories to the treaty and 148 parties, including Brazil, Peru, Colombia and most Latin American countries. How to regulate the black market of mercury trade is a serious challenge for its enforcement. In other words, the regular implementation of 'effective evaluation' by the conference (Art. 22; 23) based on related 'reports' by the signatory countries (Art. 21) would be vital. However, the consensus about its framework was not attained at the COP3 meeting in November, 2019, and it has remained an imminent agenda for future COP . According to the United Nations, 4715 tons of mercury was used in 2015, with circa 37% for ASGM, circa 2500 tons was released into the air, and circa 65% by the mining industry. See, Nakajima (2022).
2. GAIA AMAZONAS WITH THE SUPPORT OF UN ENVIRONMENT (2019) 3.
3. The Canadian Minamata Disease in Grassy Narrows and Whitedog in Ontario, Canada, due to Dryden Chemical Ltd dumping of more than 20,000 pounds of mercury into the Wabigoon river system between 1962 and 1970, is exceptionally serious. The pollution is still ongoing and affects Grassy Narrows/Whitedog First Nations. See, Yoshida (2024) 271- (originally in: MORITA(2019)). See also, e.g., Masazumi Harada et al (1976); do. et al.(2011).
4. For example, mercury contamination in the Amazon was the topic of the Global Health Consortium conference organized by Florida International University with Latin American

countries in Cartagena, Colombia, on September 15th, 2023. The author attended online and made a presentation about the Japanese Minamata Disease situation.

5. YOSHIDA(2024)279-. See also, e.g., MIYAZAWA(1997); TAKAMINE(2008).
6. See, SMITH(1975). The Japanese version was published in 1980 and 1991 by San'ichi Pub. Co. Additionally, the movie "Minamata" (2018) starring Johnny Depp was also based on Smith's story with some modification.
7. Chisso Corp. merely changed the release point from Hyakken to Hachiman in the Bayside in September, 1958, and it exacerbated the mercury contamination.
8. 696 HANREI JIHOU 15. It also criticized and invalidated the nominal amount settlements in 1959, stating that this was against public policy.
9. TSUDA(2014) 96-.
10. For his exhausted experience, see, OGATA (2016) 154-.
11. Mr. Fujii's remarks in the NHK documentary program, Close-up Modern Issues, aired on August 23rd, 2016.
12. Japanese Supreme Court decisions of October 15th, 2004, 58(7) MINSHU 1802 (state liability litigation); April 16th, 2013, 67(4) MINSHU 1115 (litigation requesting cancellation of acknowledgement denial of Minamata Disease).
13. See, TAKAOKA (2022).
14. See, OHTSUKA (2002) 508-511; (2nd ed.) (2006) 548-551; (3rd ed.) (2010) 671-674. His unreasonable position already started in the mid- 1990s in his JURIST article (vol. 1088, 1090, 1093 (1996)). For other scholars, see YOSHIDA(2024)294-, 299.
15. E.g., HARADA (1985) 155-.
16. See, for example, Itai (2024) 9-.
17. See, e.g., Harada et al. (1995).
18. E.g., Oliveira at al. (2002); Faial et al. (2015). The leading scholar of late in this field is Prof. Paulo Basta and some of his works are as follows: Basta et al. (2021 a); do. et al. (2021b); do.et al. (2021c). See also, Basta et al. (2020).
19. On September 27th, 2023, the MoU on this international joint research of the Brazilian Minamata Disease was made between the Fiocruz and the Japanese Association of Housing and Wellbeing (JAHW), one association with which I am affiliated. It consists of (i) general efforts to improve the situation regarding illegal gold mining; (ii) information sharing about the Minamata Disease; (iii) international collaboration regarding health check-ups and health education for Brazilian Minamata Disease patients; (iv) grassroots movement efforts between the two countries Brazil and Japan towards financial and in-kind infrastructural aid for affected Indigenous peoples; (v) international hybrid meetings and field work at Indigenous villages in Para State, in Roraima State, and in Amapa State etc.; and (vi) environmental Indigenous knowledge education for young generations. It is also noteworthy that a new MoU has been prepared to expand collaboration to the author's current university of affiliation, Guangdong University of Foreign Studies (GDUFS) in China with completion scheduled on August 15th, 2025.
20. See Yoshida (2024) 303-, 316- (originally in Yoshida (2022) and Yoshida (2023)). The author was originally more interested in environmental degradation including wildfires and deforestation in the Amazon and the Indigenous peoples living there. Then my great senior, Prof. Masato Ninomiya of Sao Paulo University, who knows Dr. Decio Yokota's father well, introduced me to Dr. Yokota, who happens to be an expert on Brazilian Minamata Disease. Subsequently, as a matter of course, I started to work on mercury contamination with Dr. Yokota and his program leader, Dr. Paulo Basta.
21. On the unclear situation of the mercury contamination in Roraima State, see, Yoshida (2025). Davi Kopenawa's book (2013) is an influential work that stresses mercury poisoning to the Yanomami people, but its description is shamanistic and lacks scientific data. On the other hand, Dr. Ana Paula Pina, a neurology expert who escorted the author around the CASAI (Indigenous Yanomami people hospital in Boa Vista), states that the condition of most of the Yanomami patients there can be explained in a different way; i.e. as for example, malaria, tuberculosis, chlamydia infection, onchocerciasis, syphilis, or gonorrhea. See also, Sing et al.(2003) 434 ~ (The mercury contamination situation of the Munduruku people is worse than that of the Yanomami people); Vega et al. (2018) (According to Vega, similar to Dr. Pina's understanding, Yanomami patients rather suffer from malaria, malnutrition etc.) .
22. Thus, Davi Kopenawa, a leader of the Yanomami people in Roraima state, has tried to decrease this world trend "on August 15th, 2025" and "his book (KOPENAWA" ET AL. (2013) 253-, 261-, 281-). However, in reality, it might be difficult to stop this irresistible global demand.
23. See, In the Arbitration Proceeding between Eco Oro Minerals Corp. v. The Republic of Columbia, ICSID Case No. ARB/16/41 (September 9th, 2021); Arbitration between Red Eagle Exploration Ltd. v. Republic of Columbia, ICSID Case No. ARB/18/12 (February 28th, 2024). They were discussed in the ASIL (American Society of International Law) Geneva conference on June 7th, 2024.
24. See, YOSHIDA(2024) 308, 321-322.
25. See, e.g., TAKAOKA(2022) 114-.
26. See, YOSHIDA(2024) 320. The author was surprised to meet with a young girl whose hair mercury figure was 22.1ppm, at Sawre Muybu village in March 2023 where the situation was generally better than Sawre Aboy village. Incidentally, I met with Mr. Masami Ogata (Figure 1) who faced numerous ordeals before receiving the compensatory relief for Minamata Disease, even though his hair murcury data at the age of two was 226ppm.
27. In addition to small-scale gold mining, in the face of unprecedented drought, dredging of the Amazon started in 2024. It is possible that this might further aggravate mercury contamination in the Amazon. See, Ionova (2024).
28. See recent articles in footnote 18.
29. See, ANAYA (2004) 15-23, 26-48.
30. See, YOSHIDA(2024) 311-.
31. See, Basta et al.(2021c).
32. See, YOSHIDA (2024) 323. To implement food education

that promotes eating hervivorous fish rather than poisonous carnivorous fish, I think that providing sufficient food sources by increasing transportation and possibly by giving food subsidies should be equally essential, as I've heard from from Dr. Basta's food education team that the education is not always effective.

33. I visited the JICA office in Sao Paulo to talk on this issue with the Deputy Manager Ryunosuke Kataoka on September 25th, 2023. He made proposals for applications for the Japanese Foreign Ministry's grassroots gratuitous assistance programs. Similarly, since my second visit there on March 21st, 2025, of late I've also been advised by JICA staffs Kohei Kawazuma and Erica Hieda about the related application for the JICA International Indigenous infrastructure support project.
34. In the Amazonian Minamata disease cases, more confounding factors, such as malaria, Zika virus, dengue fever and their side effects, might be surmised. Thus, we should warn about the stringent application of epidemiology based on incorrect understanding as in the Japanese civil law (tort law) scholarship. Discussions with Doctors Sandra Hacon and Paulo Basta at Fiocruz on March 20th, 2025 was thought-provoking on this point.

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