Shifting waters: The dynamics of water grabbing in Lake Toba through aquaculture and tourism development

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Abstract

This article examines the dynamics of water grabbing in Lake Toba, Indonesia, focusing on how corporate aquaculture and emerging tourism developments have reshaped access to and control over water resources. Drawing on previous studies, policy analysis, and semi-structured interviews with local net fishermen, workers from the aquaculture company in Lake Toba, NGO representatives, and government officials, the study reveals how legal permits, regulatory loopholes, and state-corporate alliances have enabled large-scale aquaculture operations to dominate lake space, marginalizing traditional fishing communities and degrading water quality. While small-scale local aquaculture faces increasing restrictions, corporate actors remain largely protected, illustrating systemic regulatory bias. In recent years, tourism-led development has introduced a new layer of water grabbing, as conservation narratives and spatial zoning are used to justify the displacement of local water users in favor of infrastructure for international sporting events and leisure industries. The case of Lake Toba demonstrates how water grabbing extends beyond agriculture and hydropower to include sectors like aquaculture and tourism, operating through a combination of legal, institutional, and symbolic mechanisms. The authors suggest addressing water grabbing challenges in Lake Toba requires more than just policy revisions; it demands strict and fair enforcement, along with governance reforms that prioritize community rights and needs.

Keywords: water grabbing, water justice, aquaculture, tourism development, Lake Toba

Résumé

Cet article examine les dynamiques d'appropriation de l'eau dans la région du lac Toba, en Indonésie, en mettant l'accent sur la manière dont l'aquaculture industrielle et les développements touristiques émergents ont redéfini l'accès et le contrôle des ressources hydriques. En s'appuyant sur des études antérieures, une analyse des politiques publiques, ainsi que des entretiens semi-directifs menés auprès de pêcheurs locaux utilisant des filets, de salariés de l'entreprise aquacole opérant sur le lac, de représentants d'ONG et de fonctionnaires, cette étude met en lumière comment les permis légaux, les failles réglementaires et les alliances entre l'État et les entreprises ont permis aux exploitations aquacoles à grande échelle de dominer l'espace lacustre, marginalisant les communautés de pêcheurs traditionnels et dégradant la qualité de l'eau. Tandis que l'aquaculture locale à petite échelle est soumise à des restrictions croissantes, les acteurs corporatifs bénéficient d'une protection largement intacte, révélant un biais systémique dans la régulation. Ces dernières années, le développement touristique a introduit une nouvelle forme d'appropriation de l'eau, où les discours de conservation et le zonage spatial servent à légitimer l'éviction des usagers locaux au profit d'infrastructures destinées aux événements sportifs internationaux et à l'industrie du loisir. Le cas du lac Toba illustre comment l'accaparement de l'eau ne se limite pas à l'agriculture ou à l'hydroélectricité, mais concerne également des secteurs tels que l'aquaculture et le tourisme, et ce à travers des mécanismes juridiques, institutionnels et symboliques. Les auteurs soutiennent que faire face aux défis liés à l'appropriation de l'eau dans cette région nécessite plus qu'une simple révision des

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politiques: cela requiert une application stricte et équitable de la loi, ainsi que des réformes de gouvernance centrées sur les droits et les besoins des communautés locales.
Mots-clés: accaparement de l'eau, justice hydrique, aquaculture, développement touristique, lac Toba

Resumen

Este artículo examina las dinámicas de acaparamiento del agua en el lago Toba, Indonesia, centrándose en cómo la acuicultura corporativa y los desarrollos turísticos emergentes han transformado el acceso y el control de los recursos hídricos. A partir de estudios previos, análisis de políticas públicas y entrevistas semiestructuradas con pescadores locales que utilizan redes, trabajadores de la empresa de acuicultura en el lago Toba, representantes de ONG y funcionarios gubernamentales, el estudio revela cómo los permisos legales, las lagunas regulatorias y las alianzas entre el Estado y las corporaciones han permitido que las operaciones acuícolas a gran escala dominen el espacio lacustre, marginando a las comunidades pesqueras tradicionales y deteriorando la calidad del agua. Mientras que la acuicultura local a pequeña escala enfrenta restricciones cada vez mayores, los actores corporativos permanecen en gran medida protegidos, lo que evidencia un sesgo sistémico en la regulación. En los últimos años, el desarrollo turístico ha introducido una nueva capa de acaparamiento del agua, en la que los discursos de conservación y la zonificación espacial se utilizan para justificar el desplazamiento de los usuarios locales del agua en favor de infraestructuras para eventos deportivos internacionales e industrias de ocio. El caso del lago Toba demuestra que el acaparamiento del agua va más allá de la agricultura y la energía hidroeléctrica, abarcando también sectores como la acuicultura y el turismo, y operando mediante una combinación de mecanismos legales, institucionales y simbólicos. Los autores sostienen que enfrentar los desafíos del acaparamiento del agua en el lago Toba requiere más que revisiones políticas: exige una aplicación estricta y equitativa de las normas, así como reformas de gobernanza que prioricen los derechos y las necesidades de las comunidades locales.
Palabras clave: acaparamiento del agua, justicia hídrica, acuicultura, desarrollo turístico, lago Toba

1. Introduction

As a global phenomenon with localized consequences, water grabbing continues its trajectory, increasingly linked to the expansion of the global food industry. A recent report (GRAIN, 2024) highlights how this phenomenon is driven by water-led farm acquisitions backed by powerful financial actors, including pension funds. Water grabbing has been broadly defined as "a process in which powerful actors are able to take control of, or reallocate to their benefit, water resources used by local communities or which feed aquatic ecosystems on which their livelihoods are based" (Mehta *et al*., 2012, p.157). This definition underscores the role of power and dispossession, particularly when water use is redirected away from customary users toward commercial or elite interests.

However, water grabbing is not a singular or uniform process; different scholars emphasize different mechanisms and consequences. For instance, Wagle *et al*. (2012) describe water grabbing as the illicit diversion of water without consultation or compensation, while Matthews (2012) focuses on the mobilization of political and institutional power to control water for hydropower, often disregarding environmental and social impacts. Arduino *et al*. (2012) stress the issue of downstream water quality loss linked to large-scale land deals, and Velez-Torres (2012) highlights coercive dispossession of minority communities to enable water infrastructure projects. Others have extended the definition to include blue water (surface and groundwater) and green water (soil moisture) appropriated under conditions of scarcity and livelihood competition (Rulli & D'Odorico, 2013; Dell'Angelo *et al*., 2018; Chiarelli *et al*., 2022).

Much of the early literature on water appropriation and conflict emerged from concerns over land grabbing, with research showing that land deals frequently entail water control (Rulli, Saviori, & D'Odorico, 2013). As Rousseau (2019) argues, land and water grabbing often occur simultaneously and reinforce each other. Accordingly, water grabbing is now widely recognized as involving not only the seizure of physical resources, but also the restructuring of governance systems to benefit investors or political elites (Bues & Theesfeld, 2012). In many cases, water use rights are acquired through formal legal mechanisms, making water grabbing a "slippery" phenomenon that is difficult to challenge on procedural grounds, even as it undermines local access (Veldwisch *et al*., 2018).

The consequences for local communities are significant. Water grabbing often results in exclusion, ecological degradation, and livelihood disruption. As Duvail *et al.* (2012) and TNI (2014) note, communities frequently suffer reduced access to clean and sufficient water, forcing them to alter long-standing practices of

water use or abandon traditional livelihoods altogether. According to GRAIN (2024), these processes prioritize the interests of the wealthy through legal mechanisms, often at the expense of local communities whose rights and needs are overlooked.

To date, most research on water grabbing has focused on agribusiness-driven land acquisitions, such as those linked to hydropower (Matthews, 2012), biofuels, or irrigation for export crops (Dell'Angelo *et al*., 2018). However, recent studies suggest that water grabbing also occurs in less-examined sectors, such as tourism-driven enclosures (Mangulama, 2024) and enterprise-owned aquaculture (GRAIN, 2024), which can similarly deny local populations access to water and related resources. These cases suggest that water grabbing is more pervasive and complex than previously assumed, involving diverse actors and sectors.

In the Indonesian context, research on water grabbing remains limited, though international studies have flagged its significance. Rulli *et al*. (2013) identify Indonesia as one of the top three countries affected by green-water grabbing due to large-scale land acquisitions. As a rapidly developing country, Indonesia has seen vast areas of forest converted into industrial plantations, infrastructure zones, and tourist destinations, transformations that often affect both land and water tenure (TNI, 2014; Yang & He, 2021). Tourism-induced land grabbing has also been linked to local water insecurity (Colorni, 2018), further demonstrating how cross-sectoral investments can produce layered resource exclusions.

This article contributes to the literature on water grabbing by analyzing the shifting dynamics of water control in Lake Toba, a nationally prioritized tourism destination, UNESCO Global Geopark member, and site of intensifying development, where the transformation of lakefront space and aquatic resources is increasingly shaped by two key sectors: aquaculture and tourism. While previous studies have illuminated how land-based investments drive water control, fewer have explored how water grabbing manifests through sectors like aquaculture and tourism. This article addresses that gap by examining how multiple development agendas intersect to reshape water governance, access, and livelihoods in Lake Toba. By considering emerging economic uses of water bodies and the legal, institutional ambiguities that accompany them, this study expands the empirical and conceptual boundaries of water grabbing research. It offers a rare case study from Indonesia, a major site of land, water transformation that remains underrepresented in academic literature; it also foregrounds tourism and aquaculture as emerging but overlooked mechanisms of water exclusion, and highlights how legal, symbolic, and governance-based processes enable water grabs that are not immediately visible through conventional lenses.

2. Setting the stage: The Lake Toba research context

Lake Toba in North Sumatra, Indonesia, is the largest volcanic lake on Earth (Chesner, 2012) and the largest lake in Southeast Asia (Fairbridge, 1968). As the largest caldera in the world (Van Bemmelen, 1930, 1949), the lake covers 1,130 km² with a maximum depth of 500 meters. The land surrounding the lake is often referred to as "the Batak land." The native people of the area are the Batak ethnic group (Vergouwen, 1964), consisting of sub-ethnic groups such as Toba Batak, Simalungun Batak, Karo Batak, Pakpak Batak, Mandailing Batak, and Angkola Batak. The lake is closely linked with Batak culture, influencing traditional cuisines, beliefs, folklore, rituals, and livelihoods (Situmorang, 1993; Naibaho & Su, 2025).

Historically, the local communities around Lake Toba relied extensively on lake water for their daily needs, such as drinking, cooking, washing, and bathing. Even until the 1990s, it was common to see local people, especially in less dense or remote areas, directly using lake water. As of 2019, of the 147 villages around the lakeside, approximately 88% continued to utilize water from the lake without further purification (Ministry of Environment and Forestry [Kementrian Lingkungan Hidup dan Kehutanan], 2019).

The lake's significant size and relatively stable water body have allowed it to support diverse ecosystem services, including transportation, tourism, and hydroelectric power generation. Additionally, water utilities managed by local governments use the lake to supply piped water to nearby towns (Saragih & Sunito, 2001; Ministry of Environment and Forestry [Kementerian Lingkungan Hidup dan Kehutanan], 2019), locally known as *Perusahaan Daerah Air Minum* (PDAM) (Ministry of Environment [Kementerian Lingkungan Hidup], 2014).

Net fishing was one of the economic activities for some local people, while others relied on agriculture for their income. In the past, fishing was carried out using a spear or a *bubu* (traditional fish trap made from

rattan or bamboo) before progressing to rod fishing and net fishing. However, today it is rare to find net fishermen who rely solely on net fishing for their livelihoods. Most of them combine net fishing with farming to make ends meet.

Although the majority of the local people are involved in farming, limited irrigation causes most farmers to rely on rainwater, limiting agricultural productivity. The topography of the water catchment around Lake Toba is mainly hilly and mountainous due to the caldera structure, which constrains the provision of irrigation facilities. The soil types in the area range from lithosols and regosols, which are generally shallow and low in fertility, to brown podzolic and brown forest soils, which offer moderate to good agricultural potential with appropriate management (Ministry of Environment [Kementerian Lingkungan Hidup], 2014). Consequently, many villages are categorized as poverty pockets (Mahulae, 2020). Historically, reliance on rain-fed agriculture led locals to practice slash-and-burn farming, causing frequent shrub and forest fires (Saragih & Sunito, 2001). To mitigate these issues and provide alternative livelihoods, the government introduced aquaculture (fish-cage farming) to the local population starting from the late 1980s.

Lake Toba and aquaculture

The use of fish cages increased significantly in Lake Toba by the mid-1990s (Figure 1). In the beginning, the government encouraged people to practice aquaculture activities and even distributed free fish seeds to locals in some lake areas (Mahulae, 2020). As a result, many local people switched their economic activities from agriculture to aquaculture.

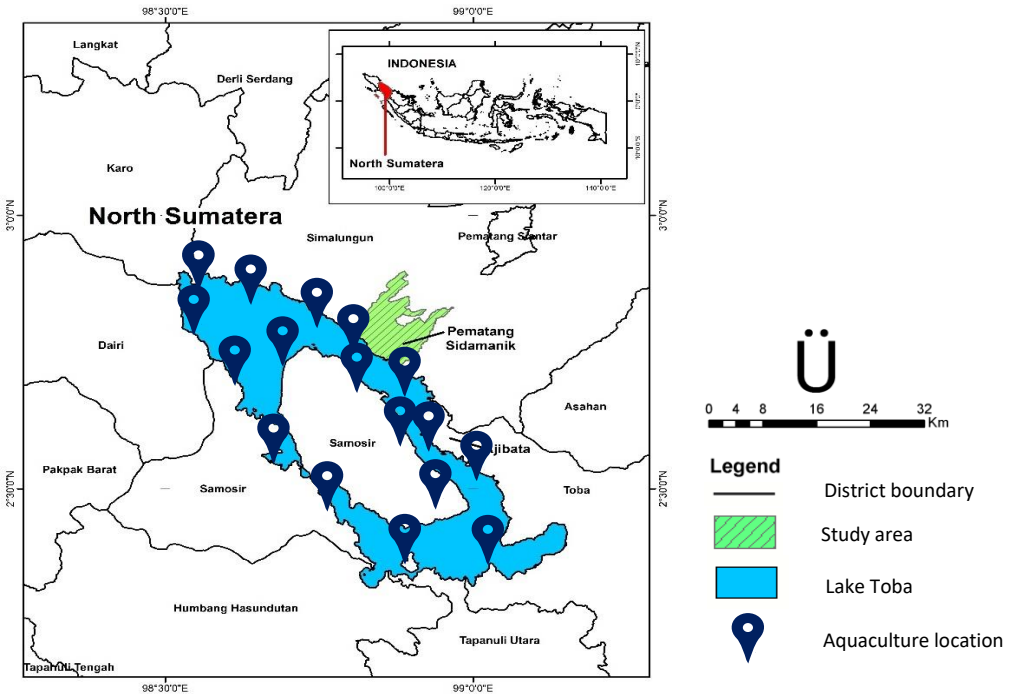

Figure 1: Lake Toba, with the location of aquaculture, both locally owned and company-owned, and the research site. Source: base map from (BIG, 2020) with modification based on data from Kementrian Lingkungan Hidup dan Kehutanan (2019) and World Bank Group (2018)

As aquaculture expanded, concerns about declining lake water quality emerged in the early 2000s, particularly regarding nutrient pollution from fish feed, causing eutrophication and growth of water hyacinth (Pontederia crassipes) on the lake surface (Saragih & Sunito, 2001). Despite such concerns, and despite

regulations designed to protect water quality, aquaculture continued to expand, intensifying debates over whether pollution was primarily driven by aquaculture or domestic waste (Tirto, 2018; Saragih & Sunito, 2001). These debates revolve around whether the priority solution should involve banning aquaculture or improving domestic wastewater systems (Mahulae *et al*., 2020).

Governance efforts and emerging tensions

Efforts to manage and protect Lake Toba have evolved significantly since the early 2000s, reflecting growing concerns about environmental degradation, yet governance outcomes have remained contested and often ineffective. Governance efforts to manage and protect Lake Toba, including the Regional Regulations (1990), the Lake Toba Ecosystem Management Plan (LTEMP, 2004), the Presidential Regulation on Lake Toba Spatial Plan (2008), the Lake Toba Rescue Initiative (GERMADAN) Program (2014), the Governor's Decrees on water quality and aquaculture carrying capacity (2017), and the recent Presidential Regulation on Priority Lakes (2021), have consistently struggled due to conflicts between environmental protection and economic development interests.

Overall, these governance initiatives illustrate a persistent conflict between environmental protection and economic development priorities. Regulatory ambiguity, weak enforcement, and ongoing tensions, particularly between environmental authorities prioritizing conservation and fisheries agencies supporting higher aquaculture productivity, have significantly undermined policy effectiveness. These persistent institutional and regulatory challenges highlight the complexity of governance challenges in contexts of competing resource interests.

Lake Toba and tourism development

The critical condition of Lake Toba and a narrative of lagging economic growth in the Lake Toba region have led to tourism development being considered as a better alternative for utilizing the lake. In 2015, the President of Indonesia announced the Ten New Bali project, a government policy aimed at developing Ten Priority Tourism Destinations as strategic tourism areas (Ministry of Tourism [Kemenpar], 2015). The government allocated a significant budget, partly borrowed from the World Bank, to develop tourism in the designated areas.

The status of the Lake Toba area as one of the Ten New Bali projects has garnered tremendous attention, both from groups interested in economic growth and those concerned about environmental issues. This momentum was also seized by an NGO to file a lawsuit against the two aquaculture companies operating in Lake Toba, a topic that will be further discussed in section 4. The degradation of the lake is perceived as a significant obstacle to promoting tourism in Lake Toba. Given that the government has already invested a substantial amount of financial capital in developing the region, many believe that strict regulation or even banning of aquaculture on the lake is necessary.

Moreover, to accommodate a tourism development project, the government converted portions of the protected forest into production forest, which was then allocated for tourism. Later, it was discovered that this allocation overlapped with the communal forest lands of local people (Imamulhadi & Kurniati, 2019), igniting a land conflict. Additional concerns have been raised about the future water security of the villagers, as the new recreational area was built near the village's water source (Mongabay, 2019) and the resort extracted groundwater to supply its water needs. These issues further intensified the existing pressures for change in the area (Naibaho & Su, 2025b).

3. Methodology

Data collection

This article employs political ecology approaches to understand environmental problems in the Lake Toba area (Batterbury, 2015). A political ecology approach helps investigate the 'slipperiness' of the water grabbing issue (Veldwisch *et al.*, 2018) by identifying drivers, enabling factors, the key actors in background processes, and winners and losers (Matthews, 2012). In particular, it assumes the existence of power imbalances

and unequal distribution of costs and benefits of environmental changes and policies (Bryant & Bailey, 1997) and gives special attention to the voice of the local people, and marginal and vulnerable groups (Robbins, 2012). Some groups of actors have lower bargaining power than others or may not even have the opportunity to bargain (Figueroa *et al*., 2024), allowing some groups to marginalize or even exclude others (Durai & Babuji, 2023; Meltzoff, Lemons, & Lichtensztajn, 2001).

Mahulae (2020) conducted a comprehensive study on aquaculture in the Lake Toba area using a political ecology approach, providing previously difficult-to-obtain data on aquaculture and conducting interviews with local people who rely on income from aquaculture. Unlike Mahulae's study, this article focuses on water-grabbing issues closely related to aquaculture activities, particularly with domestic or foreign-owned companies. The location for the interviews was different, focusing primarily on one aquaculture company that received less attention than the foreign-owned one, but both were sued by an NGO. Ongoing research began in 2017 when one author visited the Lake Toba area for research. The observation of flourishing water hyacinths was evident from the shoreline and during boat crossings. Regular visits followed during winter and summer breaks until the winter break of 2020, before the COVID-19 pandemic prohibited field visits.

Semi-structured interviews were conducted with traditional net fishermen, who were not included in Mahulae's study (2020), workers from the aquaculture company, and a local government representative (Table 1). The interviewees were chosen based on purposive sampling, a non-probability sampling method where interviewees are selected based on characteristics relevant to the research questions (Given & Saumure, 2008).

The interview questions were generally the same for each group and related to aquaculture in the Lake Toba area and its effect on the lake. Some questions were adjusted based on the group's background, such as traditional net-fishermen, aquaculture workers, and local government representatives. The interviews lasted from 50 to 70 minutes, and permission was obtained to record them.

Due to the COVID-19 pandemic restrictions, we could not visit the research sites for interviews. Instead, the author's research partner conducted some interviews in July 2021. We established the interview questions and briefed the research partner about the questions and their meaning. The audio recordings of the interviews were then sent to us for transcription and analysis. The research partner was deemed qualified to conduct the interviews, possessing a bachelor's degree with sufficient work experience.

Fortunately, as the pandemic situation improved, one of the authors visited Indonesia in the summer of 2022 and conducted follow-up research. During this phase, interviews were carried out with the Chief of the NGO that filed the lawsuit against the aquaculture company, the Representative of the provincial Fisheries Agency, and the Environment Agency. Questions during the follow-up research mainly focused on the lawsuit and its withdrawal, as well as the government's current plans for the Lake Toba Area, particularly related to aquaculture and the status of aquaculture operations in Lake Toba. Additionally, the first author visited other villages where the aquaculture sites of the foreign aquaculture company are located.

Data analysis

The data generated from the transcribed interviews were analyzed by categorizing, sequencing, and synthesizing based on the interview questions (De Vaus, 2002). The analysis then proceeded with coding and thematic identification, which entailed grouping related information (Babbie, 2004).

This article relies heavily on previous research for secondary data, particularly the study on aquaculture activity by Mahulae (2020), and also the Lake Toba Rescue Initiative report (the Toba GERMADAN of 2014), and the Lake Toba water restoration report by the World Bank (2018). There was additional document analysis, particularly examining the lawsuit filed by the NGO against the two aquaculture companies, The Lake Toba Ecosystem Management Plan (LTEMP, 2004), Presidential Regulation Number 81 of 2014 on Spatial Plan for The Lake Toba Area (Perpres No. 81, 2014), the Management Plan for Lake Toba (Kementrian Lingkungan Hidup dan Kehutanan [Ministry of Forestry and Environment], 2019), the Fifteen Priority Lakes in Indonesia (Perpres No. 60, 2021), and other documents and news reports.

Category of interviewees	Description
Traditional net-fishermen	Fishermen >40 years old and with more than ten years of net-fishing experience (n=5)
Workers of aquaculture company	Local youngsters work for the aquaculture company with more than three years of work experience (n=5)
The former Village Chief	The former village chief, 60 years old, who practices aquaculture (n=1)
The current Village Chief	The current village chief, 40 years old (n=1)
The representative of the district's tourism agency	The civil servant of the local government's tourism agency, 43 years old, with more than fifteen years of work experience for the government (n=1)
The representative of the district's environment agency	The civil servant of the local government's environment agency, 41 years old, with more than fifteen years of work experience for the government (n=1)
The representative of the provincial Fishery agency	The civil servant of provincial Fishery agency, 45 years old, with more than fifteen years of work experience for the government (n=1)
The representative of the provincial Environmental Agency	The civil servant of provincial Environmental agency, 42 years old, with more than fifteen years of work experience for the government (n=1)
The chief of an NGO	A businessman, 46 years old, with more than ten years of experience in the NGO (n=1)
A resident from the village of the supposedly new location of the aquaculture	A social worker, 31 years old (n=1)
Total	**N=18**

Table 1: Interviewees for the semi-structured interviews.

4. Findings

Aquaculture and water grabbing issue in the Lake Toba area

The development of aquaculture offers a clear example of water grabbing, where state-backed corporate access to a shared water body has led to ecological degradation and the marginalization of traditional users. Scientific and regulatory data highlight the extent to which aquaculture operations exceed the environmental limits set by government authorities, revealing systemic failures in governance and enforcement.

According to the 2017 Governor's Decree, the carrying capacity for aquaculture in Lake Toba was established at 10,000 tons of fish per year. However, production figures reported in the same year revealed that this had already been exceeded nearly fivefold. The foreign company operating in the lake produced approximately 35,000 tons annually, while the domestic company contributed 21,000 tons. In addition, local fish farmers accounted for almost 30,000 tons. This brought the total annual production to nearly 85,000 tons, eight times the legal threshold.

This excess production is also reflected in the amount of fish feed (fodder) dispersed into the lake (Figure 2). According to the Ministry of Environment and Forestry (Kementerian Lingkungan Hidup dan Kehutanan, 2019), the foreign company used over 67,000 tons of feed per year, the domestic company over 41,000 tons, and local fish farmers over 59,000 tons. This massive input of nutrients has directly contributed to the worsening ecological condition of the lake.

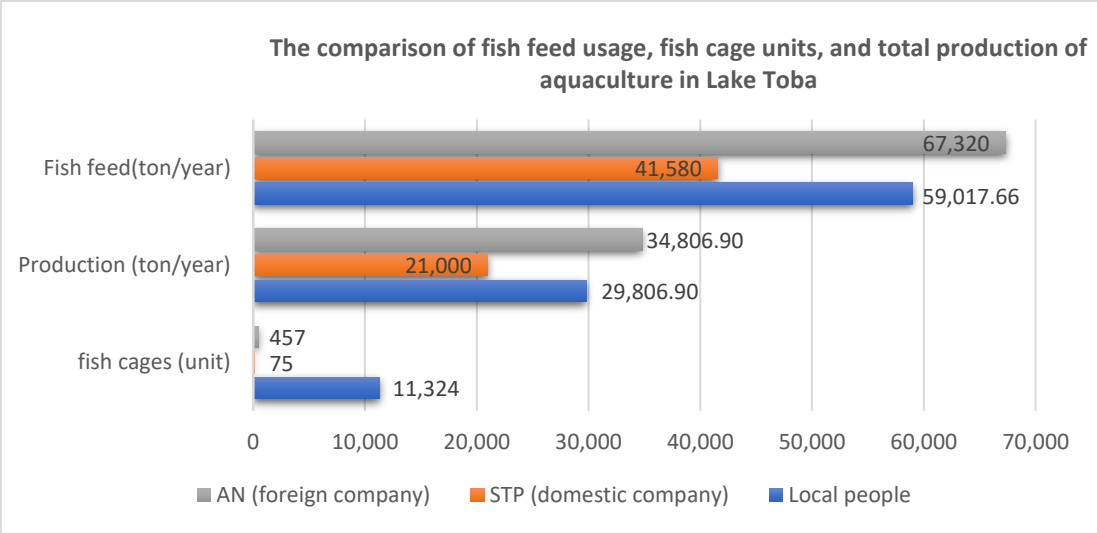

Figure 2: The fish feed usage, number of fish cage units, and total production of aquaculture among aquaculture producers in Lake Toba (source: the Ministry of Environment and Forestry [Kementrian Lingkungan Hidup dan Kehutanan], 2019). Note: the local-owned fish cages are much smaller than the company-owned ones, hence the number of fish-cages is not equal to the fish-feed usage.

The Ministry of Environment and Forestry's 2019 report identified aquaculture as the dominant source of nutrient pollution in Lake Toba, particularly in the form of phosphorus and nitrogen compounds that contribute to eutrophication and harmful algal blooms. Phosphorus pollution from aquaculture alone was estimated at 2,124 tons per year, accounting for 78% of total phosphorus pollutants, compared to just 608 tons (22%) from all other sources combined, including domestic waste, agriculture, forests, and rainfall. The World Bank (2018) similarly reported that aquaculture contributes 76% of nitrogen and 68% of phosphorus in the lake, far outpacing other contributors such as domestic wastewater, livestock, and tourism.

These findings support the environmental narrative for stricter regulation, or even banning, of aquaculture in the lake. However, this approach remains contested. Aquaculture provides income, employment, and foreign exchange for the region, especially as the production from corporate operations is largely export-oriented. Moreover, aquaculture in Lake Toba is not uniform; it includes both small-scale local operators and large corporate entities, each with differing environmental footprints and political leverage.

In response to these competing concerns, the 2017 Governor's Decree gave all aquaculture operators a five-year adjustment period to comply with the carrying capacity limit. Yet, the decree faced immediate resistance. In 2018, the provincial fisheries agency rejected the oligotrophic classification (indicating water suitable for drinking) that underpinned the 10,000-ton fish production limit. They proposed instead that Lake Toba be classified as mesotrophic, a designation indicating moderate nutrient levels, and recommended increasing the permissible aquaculture production to between 45,000 and 65,000 tons annually (Bisnis, 2018). This position was based on the agency's assertion that the lake no longer met the standards for raw drinking water and that regulatory efforts should instead focus on sustaining aquaculture as an economic activity.

The conflict over Lake Toba's water resources escalated in 2017 when the Lake Toba Heritage Foundation (YPDT) filed a lawsuit against two commercial aquaculture companies, one foreign-owned and one domestic, accusing them of polluting the lake and threatening the source of water of the 88% of local households who had long relied on the lake's water for domestic needs (YPDT, 2019). The legal action was informed by independent water testing, which corroborated earlier findings by the Ministry of Environment and Forestry (2019) and the World Bank (2018) that identified aquaculture as the largest contributor of nutrient pollution.

Beyond environmental degradation, YPDT also challenged the issuance of operational permits. According to the 2009 governor's regulation on Lake Toba's water quality, the domestic company should not have received a permit, as its operations conflicted with conservation policies. Consequently, YPDT's lawsuit also targeted the Ministry of Environment and Forestry, the Governor of North Sumatra, local district officials (Simalungun, Samosir, and Toba districts), and the Investment Coordinating Board (BKPM) for their failure to properly regulate and supervise aquaculture activities in the region.

Despite the lawsuit's outcome in January 2018, which resulted in a court order requiring the domestic aquaculture company to cease operations, the company remains active as of 2024. This continued operation, in defiance of the court ruling, raises concerns about political protection and regulatory failure. A local fisherman suggested the involvement of influential actors:

> I do not think getting rid of that aquaculture company from Lake Toba is easy. It must have had a powerful backup. If not, how can the company still operate after losing the lawsuit? (SS, 60 years old, traditional net fisherman)

This sentiment was echoed by a provincial fisheries agency representative, who confirmed that no directive had been issued by the central government to enforce the court's decision:

> We did hear about it, but until now, we have not received any official letter from the central government regarding the shutting down of that company's operation. So, we have no authority to stop the company from continuing their operation. (WD, 48 years old, Provincial Fisheries Agencies)

While the domestic company defied the court order, the lawsuit against the foreign aquaculture company was withdrawn in 2019 following indications that the judges were likely to rule in favor of the corporation (MS, YPDT Chief, 2022). Shortly after, the foreign aquaculture company rebranded to improve its public image (Medan Bisnis Daily, 2019). By the end of 2020, it announced plans to relocate its aquaculture site following a presidential regulation on Lake Toba's spatial plan. However, follow-up fieldwork in 2022 and phone interviews with locals confirmed that the company had yet to move, with respondents suggesting that administrative processes, such as permit adjustments, were causing delays:

> Some rejected, while some accepted the plan. But aquaculture has not moved to our area yet. I guess the company is still working on the administrative issue, maybe. I mean like the permit. (RS, 31 years old, social worker)

While regulatory enforcement against large-scale aquaculture remains inconsistent, public discourse has been strategically manipulated. Some officials and media figures have shifted blame for water pollution away from corporate aquaculture, instead emphasizing domestic waste as the primary culprit. Moreover, local news portals actively promote the sustainability of the foreign aquaculture company's practices, with the company itself dominating advertising space on these platforms (Metro Kampung, 2024).

Beyond regulatory and legal conflicts, the expansion of aquaculture has directly impacted traditional fishing practices. Local fishermen reported a loss of access to their traditional fishing grounds as fish cages now dominate the lake's surface. The restricted fishing areas have forced some fishermen to seek alternative, often less productive, locations to avoid conflict with corporate and local aquaculture operators. As one fisherman described:

> Before that location was used for an aquaculture company, we used to spread our fishing net there. But now, we have to find other places. Not only avoiding the company's fish-cages area, we also avoid spreading our fishing-net near the local people's fish-cages to avoid suspicion from the company's people or the local aquaculture owners. (DR, 65 years old, traditional net-fisherman)

Additionally, aquaculture infrastructure has physically obstructed lake navigation. Ropes used to secure fish cages stretch across the water, connecting cages to poles along the shore, creating barriers that hinder boat passage (Figure 3).

Figure 3: The research site shows the company's fish-cages and its ropes. (Source: screenshot of Google Earth, April 16th, 2024)

Previously, boat transportation was a routine means of accessing market days twice a week. However, due to these obstacles and the expansion of road networks, boat services have become irregular. In cases where locals still require boat transport, they must notify aquaculture workers in advance so that the ropes can be temporarily moved:

> The ropes tied to the fish cages in the lake and to several poles on the lakeshore have spread across the lake, reaching the lakeside, and have become obstacles for passing boats. (DR, 65 years old, traditional net-fisherman)

The regulatory framework surrounding aquaculture development also highlights deeper power dynamics. According to a former village chief, the establishment of corporate fish cages was legitimized through meetings attended by MUSPIDA (Regional Security Council), a body comprising the provincial governor, military commanders, police chiefs, and influential local figures. The presence of such high-ranking officials in these discussions signals the extent of state-backed support for aquaculture development. Given this strong governmental and security endorsement, local opposition to these projects remains highly constrained.

Environmental degradation remains another major concern. Several interviewees described how, before the expansion of aquaculture, the lake's water was clear and served as the primary source for drinking, bathing, and household chores. Now, however, pollution, invasive water hyacinths, and declining fish stocks have drastically altered the ecosystem:

> In the past, water was clear, and all of the villagers here used water from the lake directly. We bathed and washed our laundry and dishes in the lake and even took water with a bucket and brought it home for cooking. Now, we don't use water from the lake for daily needs anymore. We use our pipe to get the water from the upland area. (SL, 63 years old, traditional net fisherman)

Other interviewees echoed similar environmental concerns, emphasizing the shift from using lake water for daily life to seeking alternative sources. They also noted a visible increase in water hyacinths and wildlife like white storks (Milky stork, Mycteria cinerea), changes they associate with the impacts of aquaculture:

> Ah, I think if we talk about aquaculture, there are many things to say. It caused more harm than good to this area. When the mass fish kill happened, not only once, many dead fish spread on the shoreline, and it was smelly for a few days. They should have taken care of it properly. (SS, 60 years old, traditional net fisherman)

The contrast in perspectives is evident. While many lakeside residents expressed frustration over environmental degradation, villagers near the foreign aquaculture company reported that its presence had improved economic conditions. Some respondents even opposed relocation plans, citing employment benefits and monthly financial incentives provided by the company.

Despite mounting environmental evidence, including mass fish kills, declining water quality, and excessive nutrient loading, corporate aquaculture workers largely dismiss these concerns. Four out of five employees interviewed denied any significant pollution impacts, although one acknowledged that lake conditions had worsened since his childhood. This denial reflects broader patterns of institutional evasion and image management within the industry.

Regulatory enforcement also remains inconsistent and biased. While formal limits were reintroduced in 2022 based on the Governor's 2017 decree, these measures have disproportionately targeted unlicensed, small-scale local aquaculture farmers. In contrast, large corporate operators, whose production levels far exceed legal thresholds, have remained largely untouched, shielded by permits and political protection. This selective enforcement not only reflects governance disparities but also entrenches the structural inequalities underlying water access and control.

At the heart of the problem lies an unresolved tension between environmental and economic governance mandates. Environmental agencies advocate for stringent regulation grounded in scientific assessments of ecological degradation. By contrast, fisheries agencies emphasize productivity and economic contributions, proposing more lenient interpretations of lake conditions, such as reclassifying the lake's trophic status from oligotrophic to mesotrophic, to legitimize continued aquaculture growth. As a result, official policies and environmental safeguards often remain symbolic.

Ultimately, the ongoing legal, regulatory, and ecological struggles surrounding Lake Toba reveal a deeply uneven governance landscape. Power asymmetries allow corporate interests, supported by state authorities and security forces, to shape water governance in their favor, often at the expense of ecological sustainability and local livelihoods. As large-scale aquaculture continues unabated, many local people have become the silent losers of this transformation, gradually pushed out from customary fishing areas, denied clean water for daily use, and increasingly excluded from the lake that once sustained their communities.

Tourism development as emerging water grabbing

While aquaculture has already established corporate control over water, tourism development is emerging as a second wave of water grabbing, where control over Lake Toba's water resources shifts from local subsistence use to commercial leisure and hospitality industries. The Indonesian government's "Ten New Bali" initiative aims to transform Lake Toba into a high-value tourism hub, involving strict enforcement of environmental regulations against small-scale aquaculture, while corporate actors remain protected. Additionally, conservation narratives are being reframed to support tourism development rather than sustaining local livelihoods, while infrastructure expansion, such as hotels, resorts, and recreational facilities, increases the water demand for non-local, commercial purposes.

Tourism-driven water grabbing is often disguised under a conservation rhetoric, as seen in Lake Toba, where the governance is shifting favor to tourism over aquaculture, with the 2016 Presidential Regulation prioritizing tourism while framing aquaculture as an environmental threat. Following the narrative of the significant contribution of aquaculture in polluting the lake and the importance of cleaning it up to support

tourism, the government deployed the army to dismantle fish cages owned by local people, particularly those located not far from the tourist area (Metrokampung, 2021; Mongabay, 2018).

Following the presidential regulation on aquaculture zoning, there are now only five locations that are suitable for aquaculture, all of them located in Samosir district. This means people from other districts have to move their aquaculture to the designated areas. Some local aquaculture owners decided to cease fish-farming due the extra distance and additional costs (Tempo, 2022).

In contrast, an interviewee from the main research area, who lives nearby the lake where the domestic aquaculture company's fish cages spread out, decided to move his fish-cages from the lake to inland fish-farming locations by digging ponds in their already limited and precious parcel of land. The plot of land is used for rice paddies. They then divided their land to include the ponds. It is bizarre to witness how local people have to dismantle their fish-cages to quit aquaculture or move their fish-cages inland, while the domestic-company's fish-cages are spread out freely in the lake with its rope also limiting boats passing to their village (Figure 3).

To position Lake Toba as a world-class destination, the government also launched a series of international competitions, including the F1H2O World Championship in February 2023 and the Aquabike Jetski World Championship in November 2023 and 2024. These sporting events are intended to become annual ones aimed at boosting tourism in the region. To support both tourism and the logistical demands of large-scale events, the government developed new waterfront facilities in locations such as Balige and Pangururan. These developments involved transforming former locally-owned aquaculture zones (Kontan, 2023; International Media, 2023), many of which had been shut down or relocated, into event venues and recreational areas.

Furthermore, local residents living in the valley below the hill, where the Toba Caldera Resort, the new tourism authoritative zone is located, previously expressed concerns that development on the hill above their village could jeopardize their water security. They argued that the resort's reliance on groundwater, combined with the clearing of the forest that functioned to retain water and mitigate landslide risks, would negatively impact the community's water supply.

Their concerns were underscored in March and August 2022, when two landslides occurred on the hillside beneath the Toba Caldera Resort. Locals attributed the landslides to water runoff from the resort, which damaged the main village road and inundated nearby rice fields (KSPPM, 2022a, 2022b). In August of the same year, another landslide not only affected roads and rice fields but also damaged water sources. The high volume discharge resulted in flooding that uprooted community fruit trees and disrupted the water supply for several days after a major pipe burst under the pressure of the surge.

The vision to develop Lake Toba as an international tourist destination, often tagged with buzzwords like "the Monaco of Asia", "the Ten New Bali", and "super priority tourism destination", not only reflects the government's ambition to reshape the region's image but also indicates emerging practices of water grabbing driven by tourism development. This strategy is evident both directly, through the reallocation of water resources to support tourism infrastructure, and indirectly, by shifting policies that marginalize traditional aquaculture and local water uses. Such policy changes effectively justify the transformation of Lake Toba's resource governance, prioritizing commercial tourism interests over the rights and needs of local communities.

Local media and public discourse highlight water pollution from aquaculture while overlooking tourism-related environmental risks, and government incentives allocate state-backed investments to develop tourism infrastructure rather than focus on local water security. These trends reflect broader "blue grabbing", where freshwater resources are reallocated for tourism, often at the expense of indigenous and local users.

Table 2 highlights how both industries represent water grabbing, though tourism presents a new form of dispossession that redefines who gets to access and benefit from Lake Toba's water.

Dimension	Aquaculture-driven water grabbing	Emerging tourism-driven water grabbing
Primary actor	Corporate aquaculture companies	State-backed tourism investors
Water access	Exclusion of traditional fisherman and other local people	Reallocation from subsistence to commercial tourism and restriction of aquaculture in specific areas
Governance strategy	Permits issued despite pollution concerns	Regulations enforced selectively to favor tourism
Narrative control	Pollution blamed on aquaculture	Tourism framed as an environmental solution
Local impact	Fishermen displaced from traditional fishing grounds	Communities may be pushed out for tourism expansion

Table 2: The dynamic of water grabbing in Lake Toba.

The socio-political landscape around Lake Toba is complex, revealing entrenched power imbalances, selective governance enforcement, and competing narratives that prioritize commercial interests at the expense of local communities and ecological sustainability.

5. Discussion: Reframing water grabbing through the case of Lake Toba

This study set out to examine how water grabbing unfolds beyond the traditional contexts of agriculture and hydropower, using Lake Toba as a lens to explore the converging roles of corporate aquaculture, state policy, and emerging tourism agendas in reshaping access to and control over water. We have demonstrated that water grabbing is not a single-sector phenomenon, but a layered and evolving process that is both enabled and obscured by shifting governance strategies, symbolic narratives, and regulatory contradictions.

At the core of Lake Toba's water grabbing dynamics is the reallocation of water access and benefits from lakeside communities to state-supported corporate actors. Following Mehta *et al.*'s (2012) definition, this case clearly illustrates how powerful interests have appropriated water resources through formal legal channels and institutional reforms, dispossessing those who have historically depended on the lake for household use, fishing, and transportation. This is not a result of a regulatory vacuum, but rather of regulatory capture, where formal institutions and legal instruments are mobilized to serve elite interests (Hall *et al*., 2011; Bues & Theesfeld, 2012).

One of the most striking findings is how state-issued permits and contradictory regulations legitimize corporate control over the lake while marginalizing small-scale users. Despite a 2017 governor's decree that limited Lake Toba's aquaculture capacity to 10,000 tons annually, production reached nearly 50,000 tons, with the foreign-owned company alone contributing 25,000 tons. Environmental agencies cited these figures to support tighter regulation, but the fisheries agency countered by advocating for a revised carrying capacity of 45,000–65,000 tons and a downgraded water status from oligotrophic to mesotrophic (Bisnis, 2018). This inter-agency disagreement, similar to dynamics observed in other lake governance failures (Raharjo *et al*., 2019; Duvail *et al*., 2012), reflects the institutional fragmentation that enables continued overexploitation while formally maintaining environmental mandates.

This regulatory ambiguity is exacerbated by selective enforcement. The domestic company that was ordered by the court to shut down in 2018 remains in operation in 2024, while local, small-scale aquaculture operators face closures under zoning and conservation policies. This asymmetry reveals how enforcement is not a neutral act but a deeply political one, shaped by the support from influential actors like the MUSPIDA (Regional Security Council), which includes provincial officials, police, and military officers. Their participation in meetings with corporate aquaculture companies further reinforces elite support and state complicity, paralleling observations by Mehta *et al*. (2012), Fairhead *et al*. (2012), and Veldwisch *et al*. (2018).

The symbolic and narrative strategies used to justify these power asymmetries are also critical. Corporate actors have actively shaped public discourse, presenting aquaculture as a sustainable and export-driven solution to poverty while blaming domestic waste for environmental degradation. This strategy aligns with Matthews (2012) and Duvail *et al*. (2012), who argue that narrative control is a central tool in legitimizing resource reallocation. Despite scientific data from the Ministry of Environment and Forestry (2019) and the World Bank (2018) showing that aquaculture contributes to more than 75% of nutrient pollution in the lake, government narratives continue to obscure corporate responsibility.

The material impacts of water grabbing are felt most acutely by local communities. Traditional fishermen reported losing access to productive fishing areas, restricted navigation due to fish cage installations, and the need to avoid aquaculture zones to prevent conflict. The presence of ropes and barriers across the lake has physically altered mobility and access. These forms of spatial exclusion resonate with findings by TNI (2014) and Hall *et al*. (2011), who note that enclosure, whether legal, physical, or narrative, remains a key indicator of water grabbing.

The environmental degradation associated with aquaculture operations has further compounded water insecurity. Lake residents described a dramatic decline in water clarity and fish stocks, along with recurring fish kills in 2016, 2018, and 2020. Yet, interviews with corporate employees revealed a pattern of denial and downplaying of environmental harms, exemplifying the contradictions within self-regulated industries noted by Durai & Babuji (2023). Here, pollution is both visible and denied, and governance both present and absent.

Importantly, this study extends the literature by showing how tourism development now represents a second wave of water grabbing, particularly through the conversion of former aquaculture zones into tourism infrastructure. The promotion of Lake Toba as a world-class water sports destination, evidenced by annual events like the F1H2O and Aquabike World Championships, has been preceded by zoning regulations that shut down local aquaculture in places like Balige and Pangururan. These developments mirror findings by Colorni (2018) and Mangulama (2024), who identify tourism as an emerging form of dispossession cloaked in conservation language. In Lake Toba, tourism-driven water grabbing not only displaces local livelihoods but also introduces new environmental pressures through increased water-based sport events, water extraction, and infrastructure-related risks such as landslides and flooding.

By foregrounding these interrelated dynamics, this study makes three key contributions to the water grabbing literature. First, it highlights how water grabbing is often enabled not through overt land dispossession but through legal-institutional ambiguity, where state support selectively reinforces elite claims. Second, it shows how symbolic control and narrative production function as soft but powerful tools of exclusion, masking environmental harm and legitimizing appropriation. Third, it introduces tourism as a sector that deserves far more attention in water grabbing research, not only for its direct water use but for how it restructures governance and space to the detriment of customary users.

6. Conclusion

The case of Lake Toba reveals how water grabbing is not only about physical control over resources but also about legal, symbolic, and institutional processes that systematically disempower local communities. Corporate-backed aquaculture in the lake has led to widespread exclusion of traditional water users, with fishermen losing access to key fishing grounds, households facing declining water quality, and transportation routes disrupted by physical infrastructure. These impacts are not incidental: they are enabled by selective regulatory enforcement, legal protection of corporate actors, and the broader complicity of governance institutions.

Despite a court ruling mandating the closure of a domestic aquaculture company, operations continue with impunity, reflecting a pattern where laws exist but are not equitably enforced. Meanwhile, small-scale local aquaculture operators face strict regulation, displacement, or forced relocation. This imbalance exposes the deeper power structures embedded in resource governance, where state-corporate alliances and security apparatuses prioritize investment interests over the rights and welfare of local populations.

Adding further complexity, the rise of tourism in Lake Toba introduces a second wave of water grabbing. Large-scale infrastructure projects and international sports events have repurposed former aquaculture zones and reshaped lakefront access. Conservation narratives now serve to legitimize the removal of local livelihoods

under the guise of environmental protection and tourism development. These transformations, while presented as progress, have intensified water insecurity and reduced community control over their environment.

Addressing these challenges demands more than policy reform. It requires a shift in governance practices that centers transparency, accountability, and inclusive decision-making. While Lake Toba's designation as a national priority lake creates opportunities for coordinated action, meaningful change depends on sustained political will and active participation from affected communities.

Beyond Lake Toba, this study contributes to a broader understanding of water grabbing by drawing attention to underexamined sectors like aquaculture and tourism. It highlights how water appropriation is increasingly driven by overlapping economic agendas, backed by legal and institutional frameworks that obscure accountability. This research calls for greater attention to the subtle and layered mechanisms through which water grabbing occurs, mechanisms that are not always visible through conventional analyses.

The findings from Lake Toba offer important lessons for other regions in Indonesia and beyond, particularly for the country's fifteen other priority lakes. As pressures on water resources continue to grow, it becomes essential to recognize the multiple and evolving faces of water grabbing, and to respond with governance frameworks that are equitable, transparent, and grounded in the lived realities of local communities.

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