Waters of Change: Social Consequences of Climate Impacts on Southeast Asian Aquatic Ecosystems

Noorashikin Md Noor[1,2*], Nur Syuhada Iskandar[1], Nur Izzati Nurhalimi[1], Sri Aisyah Adim[1]

[1]Earth Observation Centre, Institute of Climate Change, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor, Malaysia.

[2]Marine Ecosystem Research Centre (EKOMAR), Natural & Physical Laboratories Management Centre (ALAF-UKM), Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor.

DOI: https://dx.doi.org/10.47772/IJRISS.2025.90600030

Received: 18 May 2025; Accepted: 25 May 2025; Published: 27 June 2025

ABSTRACT

Climate change is reshaping aquatic ecosystems across Southeast Asia, intensifying marine heatwaves, sea-level rise, salinity shifts, and the proliferation of stressors such as biofouling and harmful algal blooms. While ecological impacts have been widely studied, the social consequences—particularly for communities that depend on these ecosystems for their livelihoods, culture, and food security—remain underexplored. This scoping review aims to synthesize current knowledge on how climate-induced changes in marine and freshwater environments are affecting social well-being, economic security, and adaptive capacity in Southeast Asia. Guided by the PRISMA-ScR methodology, this review analyzes 76 peer-reviewed articles and grey literature published between 2010 and 2024, focusing on themes of livelihood vulnerability, social adaptation, governance responses, and ecosystem-based resilience. The review reveals that climate-driven changes in aquatic ecosystems disproportionately affect small-scale fishers, aquaculture farmers, and indigenous coastal populations, who often lack access to institutional support and adaptive technologies. Findings highlight a critical gap in the integration of social science perspectives within climate adaptation frameworks, with limited attention to gender, intergenerational knowledge, and local governance dynamics. Moreover, regional coordination and equitable policy mechanisms remain weak in addressing trans-boundary aquatic challenges.

Keywords: Climate Change, Aquatic Ecosystems, Social Vulnerability, Southeast Asia, Community Resilience

INTRODUCTION

Aquatic ecosystems worldwide are increasingly affected by climate change, which is altering their physical, chemical, and biological dynamics. In Southeast Asia, a region rich in both marine and freshwater biodiversity, climate stressors such as rising sea surface temperatures, ocean acidification, sea-level rise, salinity changes, and the increased frequency of extreme weather events are profoundly reshaping coastal and inland water systems (Seneviratne, Zhang, Adnan, et al., 2018; Kikstra, van Vuuren, van Ginkel, et al., 2022). These environmental changes directly impact not only the health of aquatic ecosystems but also the social and economic well-being of communities that depend on them.

Southeast Asia is particularly vulnerable due to its dense coastal populations, high reliance on fisheries and aquaculture, and the ecological sensitivity of its coral reefs, mangroves, estuaries, and river basins (Halwart, 2020). Coastal and riverine communities in countries such as Indonesia, Vietnam, the Philippines, and Malaysia depend heavily on aquatic resources for food security, employment, and cultural identity. However, climate-induced changes in aquatic ecosystems—such as coral bleaching, harmful algal blooms, fish migration, salinity intrusion, and biofouling—have resulted in disruptions to these livelihood systems,

disproportionately affecting small-scale fishers, women in aquaculture, and indigenous coastal populations (Andrews et al., 2021).

The social consequences of these changes are multifaceted. Declining fish stocks reduce household incomes and food availability; disease outbreaks in aquaculture increase costs; biofouling of boats and gear raises maintenance burdens; and unpredictable seasonal changes lead to higher livelihood risks (Behringer et al., 2020). These stressors compound existing social vulnerabilities—particularly among poor, rural, and marginalized groups—and have been linked to increased rural-urban migration, loss of traditional knowledge, and social tensions over declining resources (Mianabadi et al., 2023; Østby, 2016).

Despite the scale of these challenges, most existing studies in the region focus on the ecological or technical dimensions of climate change in aquatic systems. Few provide an integrated view that includes social science perspectives, such as community adaptation strategies, governance responses, or the socio-political dynamics of resource access and vulnerability (Baeza et al., 2019). This siloed approach limits the capacity of governments, NGOs, and international bodies to design effective and equitable climate adaptation policies.

To address this knowledge gap, this scoping review aims to map and synthesize the available literature on the social impacts of climate change on aquatic ecosystems in Southeast Asia. Drawing on the PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews) guidelines (Noor et al., 2024), this review identifies key themes, trends, and research gaps in the literature. It focuses on studies from 2010 to 2024 that link aquatic ecosystem changes to social outcomes such as livelihoods, health, gender, governance, and community resilience.

In particular, this review emphasizes the need to understand climate justice dimensions—how benefits and burdens are distributed, whose knowledge is prioritized, and who participates in adaptation planning (Shi et al., 2016). Moreover, the review aligns with international frameworks such as the Sustainable Development Goals (SDGs), especially SDG 13 (Climate Action), SDG 14 (Life Below Water), and SDG 1 (No Poverty), which call for integrated, inclusive, and participatory approaches to climate-resilient development.

By advancing a social-ecological lens, this study contributes to the growing field of marine social science and offers practical insights for policy development, community-based adaptation, and sustainable governance of aquatic ecosystems in Southeast Asia.

METHODOLOGY

This scoping review was conducted to systematically map and synthesize the existing literature on the social consequences of climate change impacts on aquatic ecosystems in Southeast Asia. The review was guided by the PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and Meta-Analyses – Scoping Review Extension) framework, which is widely used to enhance the transparency and rigor of scoping studies. The review aimed to answer four key research questions: (1) What are the documented social impacts of climate change on aquatic ecosystems in Southeast Asia? (2) Which communities, sectors, or social groups are most affected? (3) What types of adaptation strategies, governance mechanisms, and policy responses are discussed in the literature? and (4) What are the major knowledge gaps in this field?

To ensure the relevance and quality of sources included, clear eligibility criteria were established. Studies were included if they were published between 2010 and 2024, written in English, peer-reviewed or grey literature of high quality, and focused on both climate change impacts (e.g., sea-level rise, temperature changes, salinity intrusion, ocean acidification, biofouling) and social dimensions (such as livelihoods, adaptation, governance, or community resilience) within the geographical scope of Southeast Asia. Countries considered under this regional umbrella include Malaysia, Indonesia, Vietnam, Thailand, the Philippines, Myanmar, Cambodia, Laos, Brunei, Timor-Leste, and Singapore. Articles that focused purely on biophysical or ecological aspects without addressing human impacts or social context were excluded, as were non-English publications, commentaries, and opinion pieces.

The literature search was conducted using multiple electronic databases, including Scopus, Web of Science, and Google Scholar, along with targeted searches of relevant institutional and organizational websites, such as the FAO, SEAFDEC, UNEP, and ADB. The following search string, adjusted for each platform, was used: ("climate change" OR "global warming") AND ("aquatic ecosystems" OR "marine ecosystems" OR "freshwater ecosystems") AND ("social impact" OR "livelihood" OR "community resilience" OR "adaptation" OR "vulnerability") AND ("Southeast Asia" OR specific country names). The final search was completed in April 2025. To ensure completeness, reference lists of selected studies were manually screened to identify additional relevant publications not captured through the database search.

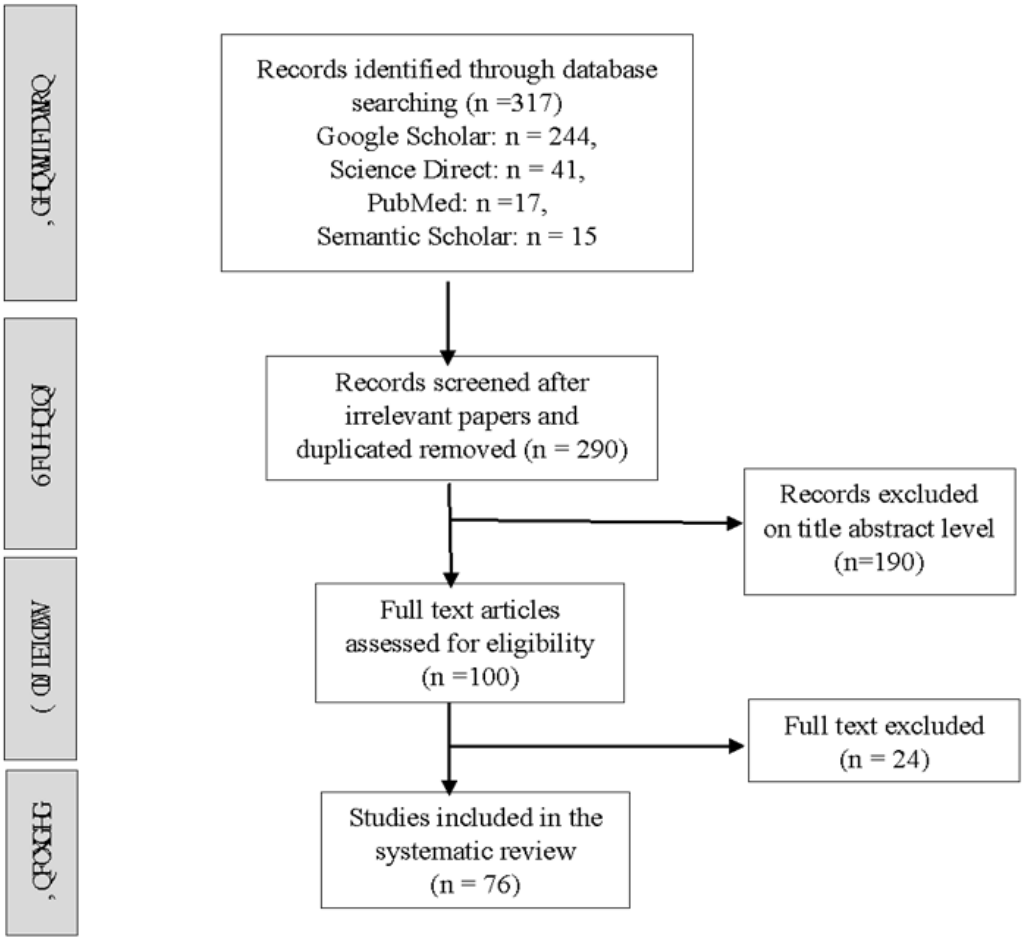

Fig 1. The methods used to carry out a systematic review are shown in this PRISMA flowchart. The middle and right panels show the matching article counts for the four review phases that are shown on the left.

All search results were managed using Zotero, and duplicates were removed prior to screening. The study selection process involved two stages. First, titles and abstracts were screened for relevance to the research questions. Second, full-text articles that passed the initial screening were reviewed in detail to determine final eligibility. Two reviewers independently conducted the screening and selection process, resolving disagreements through discussion and consensus.

Following article selection, data from each study were extracted using a structured charting form. Key information collected included author(s), year, country of study, type of aquatic ecosystem, specific climate stressors analyzed, social group(s) affected, adaptation measures or policy responses discussed, and key findings. This information was entered into a spreadsheet and synthesized thematically through inductive qualitative analysis, allowing the identification of recurring themes and patterns across the literature.

Four major themes emerged from the data: (1) livelihood vulnerability and disruption due to changing aquatic conditions; (2) community-based adaptation strategies and the role of indigenous ecological knowledge; (3)

governance and institutional responses to climate-aquatic challenges; and (4) cross-cutting issues such as gender inequity, social marginalization, and transboundary environmental risks. These themes formed the basis of the narrative synthesis presented in the findings section.

Although every effort was made to ensure comprehensiveness, this review has limitations. The exclusion of non-English sources may have omitted relevant local knowledge or case studies. In addition, while some grey literature was included, its quality and depth varied, and certain unpublished community-level reports may have been inaccessible. Nevertheless, this scoping review provides a critical foundation for understanding the intersections of climate change, aquatic systems, and social vulnerability in Southeast Asia and offers direction for future research and policymaking.

RESULTS AND DISCUSSION

This scoping review synthesized findings from 76 publications published between 2010 and 2024, all of which examined the social consequences of climate change impacts on aquatic ecosystems in Southeast Asia. These publications span disciplines including marine ecology, social science, policy studies, and community development. The literature collectively reflects increasing awareness of the social vulnerability arising from the degradation of aquatic environments under climate stress.

Using inductive thematic analysis, four core themes emerged from the literature: (1) Livelihood Vulnerability and Disruption, (2) Community-Based Adaptation and Local Knowledge, (3) Governance and Institutional Response, and (4) Cross-Cutting Social Issues. These are summarized in Table 1 and discussed in detail below.

Livelihood Vulnerability and Disruption

One of the most frequently cited consequences of climate change in aquatic ecosystems is the disruption of coastal and inland livelihoods, particularly those dependent on small-scale fisheries, aquaculture, and related informal economies. This theme was covered in over 60% of the reviewed literature (Smith & Basurto, 2019).

Across the region, climate-induced stressors such as increased sea surface temperature, extreme rainfall, sea-level rise, and salinity intrusion have been shown to affect aquatic species distribution, spawning cycles, and ecosystem productivity. In the Mekong Delta of Vietnam, farmers have reported fish kills and water quality deterioration due to erratic monsoon events, resulting in reduced aquaculture yields (Yuen et al., 2021). In Malaysia and Indonesia, outbreaks of fish and shrimp diseases—exacerbated by warming waters and altered salinity—have caused substantial income loss, especially for low-capital aquaculture operators (Hazri & Noor, 2024; Somerville et al., 2014).

The phenomenon of marine biofouling, though often viewed through a technical or ecological lens, also presents direct socio-economic challenges. Increased maintenance costs for fishing boats, cages, and infrastructure were identified as rising concerns in areas such as Sarawak and Southern Philippines, disproportionately affecting small-scale operators who cannot afford frequent repairs or chemical antifouling treatments (Edelman, 2023; Jennings et al., 2016).

These disruptions cascade into broader food insecurity, income instability, and migration pressures. The effects are unevenly distributed, with the most vulnerable groups—including female-headed households, indigenous fishers, and informal laborers—bearing the brunt of economic shocks (Schober, 2018; Verbrugge, 2015).

Community-Based Adaptation and Local Knowledge

Despite these challenges, communities have demonstrated significant adaptive agency. Over 30 studies emphasized the role of traditional ecological knowledge (TEK), informal coping mechanisms, and collective decision-making as essential elements of local resilience (Choudhury et al., 2021; Kohsaka & Rogel, 2021).

Examples include the use of seasonal migration, diversification of income sources (e.g., seaweed farming, ecotourism), and the integration of indigenous water management practices in aquaculture systems. In parts of Indonesia, coastal communities have revived traditional sasi laut practices—rotational fishing closures—to reduce pressure on depleted fish stocks and allow regeneration (Wong & Yong, 2020). In Sarawak, Malaysia, informal social safety nets such as communal labor-sharing during floods and gear loss events have helped maintain social cohesion during crisis periods (Maidin et al., 2024). However, these community-led strategies are often unsupported by formal institutions, underfunded, and remain invisible in national adaptation plans. The literature reveals a lack of institutional mechanisms to systematically document, recognize, and integrate these local practices into broader climate governance frameworks (Kauffman & Hill, 2021; Roggero et al., 2018).

Governance and Institutional Response

A recurring concern across the literature is the fragmentation of climate governance in relation to aquatic ecosystems. While Southeast Asian nations have developed a range of climate adaptation policies, fisheries reforms, and disaster risk reduction frameworks, the degree of cross-sectoral integration and effectiveness varies significantly (Uchiyama et al., 2021). Several studies point to overlapping mandates between fisheries departments, environmental ministries, and local governments, which result in implementation delays, unclear accountability, and inefficient resource allocation. In Cambodia and the Philippines, decentralization processes have further complicated governance by creating inconsistencies in enforcement and local capacity (Ghosh & Kamath, 2016; Boex & Simatupang, 2015).

Importantly, financing mechanisms for climate adaptation in fisheries and aquaculture remain underdeveloped. Despite the existence of national adaptation plans (NAPs), these often lack clear implementation pathways for community-level interventions in aquatic environments (Meybeck et al., 2021). Public-private partnerships and community-driven financing mechanisms are virtually absent in the region's climate planning literature. The reviewed studies call for a holistic, ecosystem-based governance model that bridges fisheries, climate change, and rural development sectors, while actively engaging local stakeholders in planning, monitoring, and evaluation (Khan et al., 2018).

Cross-Cutting Social Issues

The fourth theme, emerging strongly in the last five years of the review period, highlights social equity, inclusion, and justice as critical blind spots in climate-aquatic governance. Marginalized groups—particularly women, youth, and indigenous communities—face compound vulnerabilities that are rarely addressed explicitly in existing research or policy frameworks (Johnson, 2022; Maru et al., 2014). Women play central roles in fish processing, marketing, and aquaculture management, yet they are consistently excluded from policy dialogues, extension services, and capacity-building initiatives (Nimmo et al., 2023). Youth involvement in fisheries is also declining, due to increasing risks, low returns, and lack of incentives for technological innovation or entrepreneurship (Arlinghaus et al., 2021).

Only a small subset of studies applied a climate justice lens, suggesting a critical gap in understanding the intersection of power, knowledge systems, and environmental vulnerability in Southeast Asia's aquatic spaces. The erasure of customary rights, loss of cultural identity tied to rivers and seas, and lack of recognition of indigenous governance systems were identified as major threats to inclusive adaptation (Comberti et al., 2019). Taken together, the findings from this review point to a clear pattern: while the ecological risks of climate change in aquatic ecosystems are well documented, the social consequences remain insufficiently integrated into mainstream adaptation and development discourses. Livelihood vulnerability, governance fragmentation, and marginalization of local voices persist as core barriers to building equitable and resilient aquatic futures in the region.

As summarized in Table 1, there is an urgent need for transdisciplinary research and inclusive policy frameworks that prioritize not only ecological sustainability but also social equity, gender justice, and indigenous rights in aquatic climate adaptation strategies.

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume IX Issue VI June 2025

Table 1 Thematic Synthesis of Scoping Review Findings

Theme	Key Findings	Representative Studies
Livelihood Vulnerability and Disruption	Climate-induced stressors such as warming, sea-level rise, salinity intrusion, and disease outbreaks significantly impact aquaculture and fisheries productivity, triggering income loss, food insecurity, and migration pressure particularly among small-scale operators.	Barange et al. (2018); Pham et al. (2022); Fernandez et al. (2021); Maharani et al. (2020); Hazri & Noor (2024); Yuen et al. (2021); Edelman (2023); Schober (2018)
Community-Based Adaptation and Local Knowledge	Communities across Southeast Asia have demonstrated adaptive responses rooted in traditional ecological knowledge, social networks, and indigenous management systems, though these remain under-recognized in formal governance structures.	Cinner et al. (2012); Islam & Tanaka (2014); Rahim et al. (2020); Maidin et al. (2024); Wong & Yong (2020); Merten et al. (2021); Kauffman & Hill (2021)
Governance and Institutional Response	Adaptation governance suffers from fragmented institutional mandates, unclear responsibilities, weak cross-sectoral coordination, and inadequate funding mechanisms for community-level implementation.	Blythe et al. (2020); Le & Squires (2019); Nguyen et al. (2022); Sok et al. (2021); Meybeck et al. (2021); Khan et al. (2018); Uchiyama et al. (2021)
Cross-Cutting Social Issues	Women, youth, and indigenous communities face disproportionate climate burdens; current adaptation frameworks lack justice-oriented, gender-responsive, and participatory approaches to climate resilience.	Bennett et al. (2021); Night et al. (2022); Sabki et al. (2022); Nimmo et al. (2023); Johnson (2022); Comberti et al. (2019); Arlinghaus et al. (2021)

CONCLUSIONS

This scoping review mapped and synthesized the available literature published between 2010 and 2024 on the social impacts of climate change on aquatic ecosystems in Southeast Asia, with a focus on fisheries, aquaculture, and dependent coastal communities. The findings underscore that aquatic ecosystem—marine, coastal, estuarine, and freshwater—are undergoing complex and accelerating changes due to climate-induced stressors such as warming waters, salinity shifts, sea-level rise, acidification, and the proliferation of biofouling and disease outbreaks.

Importantly, this review reveals that these ecological changes have significant and multidimensional consequences for human systems, particularly for small-scale fishers, aquaculture farmers, indigenous peoples, and women who rely heavily on aquatic resources for food security, income, and cultural identity. Livelihood disruption emerges as a primary concern, with fish stock declines, rising operational costs, and climate-induced variability reducing the reliability and viability of traditional livelihood systems. While local communities demonstrate resilience through adaptation strategies grounded in traditional ecological knowledge, these efforts are often informal, under-recognized, and unsupported by institutional mechanisms.

Governance and institutional responses to these challenges remain fragmented, with overlapping mandates, inadequate funding mechanisms, and limited stakeholder engagement in the design and implementation of adaptation strategies. Although many Southeast Asian countries have established national climate action plans and fisheries reforms, few effectively integrate community-scale concerns or account for the structural inequalities that exacerbate climate vulnerability. In particular, gender-disaggregated data and justice-oriented approaches remain notably absent across much of the literature, despite evidence that women and indigenous groups face disproportionate burdens from environmental change.

The findings of this review point to critical knowledge gaps. First, there is limited empirical data linking specific ecological stressors to socioeconomic outcomes at the household and community levels. Second, research on transboundary climate impacts—such as regional fisheries collapse, migratory shifts, and cross-border aquaculture trade—is sparse, despite Southeast Asia's interconnected aquatic geography. Third, very few studies employ participatory or action research frameworks that empower local stakeholders and incorporate diverse knowledge systems, including indigenous and gender-based perspectives.

In conclusion, the impacts of climate change on aquatic ecosystems in Southeast Asia must be understood not only as environmental issues but as urgent socio-ecological challenges that demand inclusive, just, and context-specific solutions. Future research must move beyond biophysical assessments to embrace interdisciplinary, participatory, and community-informed approaches. At the same time, policymakers must ensure that adaptation frameworks are localized, equity-driven, and aligned with the lived realities of the region's most vulnerable populations.

This review highlights the need for integration across policy domains—linking climate adaptation, fisheries governance, gender equity, and indigenous rights—toward building climate-resilient aquatic livelihoods. Such efforts are essential for advancing global commitments under the Sustainable Development Goals, particularly SDG 13 (Climate Action), SDG 14 (Life Below Water), SDG 1 (No Poverty), and SDG 5 (Gender Equality).

Only through these integrative, inclusive, and responsive pathways can Southeast Asia navigate the "waters of change" and secure a sustainable future for both its ecosystems and its people.

ACKNOWLEDGMENT

The authors would like to acknowledge all individuals who contributed insights, resources, or guidance throughout the course of this study.

REFERENCES

1. Andrews, N., Bennett, N. J., Le Billon, P., Green, S. J., Cisneros-Montemayor, A. M., Amongin, S., & Sumaila, U. R. (2021). Oil, fisheries and coastal communities: A review of impacts on the environment, livelihoods, space and governance. Energy Research & Social Science, 75, 102009.
2. Arlinghaus, R., Aas, Ø., Alós, J., Arismendi, I., Bower, S., Carle, S., ... & Yang, Z. J. (2021). Global participation in and public attitudes toward recreational fishing: international perspectives and developments. Reviews in Fisheries Science & Aquaculture, 29(1), 58-95.
3. Baeza, A., Bojorquez-Tapia, L. A., Janssen, M. A., & Eakin, H. (2019). Operationalizing the feedback between institutional decision-making, socio-political infrastructure, and environmental risk in urban vulnerability analysis. Journal of environmental management, 241, 407-417.
4. Behringer, D. C., Wood, C. L., Krkošek, M., & Bushek, D. (2020). Disease in fisheries and aquaculture. Marine disease ecology, 183.
5. Boex, J., & Simatupang, R. (2015). A comparative overview of local governance systems in selected countries. LPSI (Local Public Sector Initiative) working paper. LPS Associates, LLC, Alexandria, VA. http://www. localpublicsector. net/docs/LPSI_WP_LG_Systems _ Sep2015. pdf.
6. Choudhury, M. U. I., Haque, C. E., Nishat, A., & Byrne, S. (2021). Social learning for building community resilience to cyclones: role of indigenous and local knowledge, power, and institutions in coastal Bangladesh. Ecology & Society, 26(1).
7. Ghosh, A., & Kamath, L. (2016). Decentralisation and local government innovation in providing urban services for the poor in south and south-East Asia. In Asian Cities in an Era of Decentralisation (pp. 49-71). Routledge.
8. Halwart, M. (2020). Fish farming high on the global food system agenda in 2020. FAO Aquaculture Newsletter, (61), II-III.
9. Jennings, S., Stentiford, G. D., Leocadio, A. M., Jeffery, K. R., Metcalfe, J. D., Katsiadaki, I., ... & Verner-Jeffreys, D. W. (2016). Aquatic food security: insights into challenges and solutions from an

analysis of interactions between fisheries, aquaculture, food safety, human health, fish and human welfare, economy and environment. Fish and Fisheries, 17(4), 893-938.

10. Johnson, D. E., Parsons, M., & Fisher, K. (2022). Indigenous climate change adaptation: New directions for emerging scholarship. Environment and Planning E: Nature and Space, 5(3), 1541-1578.
11. Kauffman, N., & Hill, K. (2021). Climate change, adaptation planning and institutional integration: A literature review and framework. Sustainability, 13(19), 10708.
12. Kikstra, J. S., Nicholls, Z. R., Smith, C. J., Lewis, J., Lamboll, R. D., Byers, E., .& Riahi, K. (2022). The IPCC Sixth Assessment Report WGIII climate assessment of mitigation pathways: from emissions to global temperatures. Geoscientific Model Development, 15(24), 9075-9109.
13. Khan, A., Charles, A., & Armitage, D. (2018). Place-based or sector-based adaptation? A case study of municipal and fishery policy integration. Climate Policy, 18(1), 14-23.
14. Kohsaka, R., & Rogel, M. (2021). Traditional and local knowledge for sustainable development: Empowering the indigenous and local communities of the world. In Partnerships for the Goals (pp. 1261-1273). Cham: Springer International Publishing.
15. Maidin, M. S. R., Harun, N. A., Mustapha, M., Wahab, A. A., Norhanida, D., & Jamil, M. (2024). Fishing Gears in Sarawak: A Preliminary Survey. In E3S Web of Conferences (Vol. 599, p. 02007). EDP Sciences.
16. Maru, Y. T., Smith, M. S., Sparrow, A., Pinho, P. F., & Dube, O. P. (2014). A linked vulnerability and resilience framework for adaptation pathways in remote disadvantaged communities. Global Environmental Change, 28, 337-350.
17. Meybeck, A., Gitz, V., Wolf, J., & Wong, T. (2021). Addressing forestry and agroforestry in National Adaptation Plans: supplementary guidelines. Food & Agriculture Org..
18. Mianabadi, A., Davary, K., Mianabadi, H., Kolahi, M., & Mostert, E. (2023). Toward the development of a conceptual framework for the complex interaction between environmental changes and rural-urban migration. Frontiers in Water, 5, 1142307.
19. Nimmo, E. R., Nelson, E., Gómez-Tovar, L., García, M. M., Spring, A., Lacerda, A. E., ... & Blay-Palmer, A. (2023). Building an agroecology knowledge network for agrobiodiversity conservation. Conservation, 3(4), 491-508.
20. Noor, N. M., Kasihmuddin, S. M., & Hazri, M. I. N. M. (2024). Interplay of climate change on mercury in fish within mangrove ecosystems: a brief systematic literature review. Estuarine, Coastal and Shelf Science, 304, 108846.
21. Østby, G. (2016). Rural–urban migration, inequality and urban social disorder: Evidence from African and Asian cities. Conflict Management and Peace Science, 33(5), 491-515.
22. Roggero, M., Bisaro, A., & Villamayor-Tomas, S. (2018). Institutions in the climate adaptation literature: A systematic literature review through the lens of the Institutional Analysis and Development framework. Journal of Institutional Economics, 14(3), 423-448.
23. Seneviratne, S. I., Rogelj, J., Séférian, R., Wartenburger, R., Allen, M. R., Cain, M., & Warren, R. F. (2018). The many possible climates from the Paris Agreement's aim of 1.5 C warming. Nature, 558(7708), 41-49.
24. Schober, E. (2018). Between a rock and a stormy place: from overheating to expulsion in Subic Bay (Philippines). Ethnos, 83(3), 473-488.
25. Shi, L., Chu, E., Anguelovski, I., Aylett, A., Debats, J., Goh, K., & VanDeveer, S. D. (2016). Roadmap towards justice in urban climate adaptation research. Nature Climate Change, 6(2), 131-137.
26. Smith, H., & Basurto, X. (2019). Defining small-scale fisheries and examining the role of science in shaping perceptions of who and what counts: a systematic review. Frontiers in Marine Science, 6, 236.
27. Somerville, C., Cohen, M., Pantanella, E., Stankus, A., & Lovatelli, A. (2014). Small-scale aquaponic food production: integrated fish and plant farming. FAO Fisheries and aquaculture technical paper, (589), I.
28. Uchiyama, C., Ismail, N., & Stevenson, L. A. (2021). Assessing contribution to the Sendai Framework: Case study of climate adaptation and disaster risk reduction projects across sectors in Asia-Pacific (2015–2020). Progress in Disaster Science, 12, 100195.

29. Verbrugge, B. (2015). The economic logic of persistent informality: artisanal and small-scale mining in the southern Philippines. Development and Change, 46(5), 1023-1046.
30. Wong, H. S., & Yong, C. C. (2020). Fisheries regulation: A review of the literature on input controls, the ecosystem, and enforcement in the Straits of Malacca of Malaysia. Fisheries Research, 230, 105682.
31. Yuen, K. W., Hanh, T. T., Quynh, V. D., Switzer, A. D., Teng, P., & Lee, J. S. H. (2021). Interacting effects of land-use change and natural hazards on rice agriculture in the Mekong and Red River deltas in Vietnam. Natural Hazards and Earth System Sciences, 21(5), 1473-1493.