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Hydropower development and the neglect of inland capture fisheries from a food systems perspective: the case of the Lower Mekong Basin

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Abstract

This paper addresses why food security implications of projected losses to inland capture fisheries due to hydropower development have been neglected in policy arenas. Drawing on the case of the Lower Mekong Basin, this paper applies a conceptual framework for analysing this question as a case of fundamental food system change. Four inter-related axes of change – narratives, actors, institutions and resources – constitute the framework for analysing and challenging the dynamics and values of food systems change. Despite substantial scientific evidence on the nutritional and food security significance of the fisheries, and the magnitude of negative impacts of planned hydropower development, there has been no discernible shift in hydropower investment and related policy. The lack of attention to this food production loss is due to a broader transformation in food systems, itself shaped by powerful interests and values. Addressing the neglect of fisheries requires challenging this trajectory of food system change.

KEYWORDS: Food systems; inland capture fisheries; hydropower; political ecology; Mekong; policy neglect

Introduction

Inland capture fisheries in the Global South are widely recognised for their contribution to livelihoods and nutrition (Funge-Smith, 2018) yet face significant threats from hydropower development. In Bangladesh, hydropower development on the Indian Ganges and large-scale refashioning of floodplain ecosystems are negatively impacting the productivity of capture fisheries (Ainsworth et al. 2020). Despite this, inland capture fisheries are frequently overlooked in national policies that focus on aquaculture intensification and marine fisheries (Islam et al., 2021). Such neglect cannot be explained simply in terms of a lack of information, evidence or knowledge about the importance of capture fisheries or impacts of hydropower.

The Lower Mekong Basin is a case of special significance. While these fisheries face a range of pressures from climate change to transformations of agricultural landscapes, large-scale hydropower development stands out as the greatest single threat to productivity, with enormous implications for food security (Dugan et al. 2010; Winemiller et al. 2016). The identification of hydropower as such a threat is not new, dating back to assessments of the Mekong Secretariat in the 1960s (Friend et al., 2009). Yet despite a substantial body of more recent scientific evidence on the significance of these fisheries and the magnitude of impact of planned hydropower development for food security (DHI 2015; MRC 2016), there has been no discernible shift in hydropower investment and related policy (Campbell and Barlow 2021) – even when such assessments have been conducted under the auspices of the inter-governmental Mekong River Commission.

The challenge of hydropower development in the region has been framed by its proponents as a trade-off between energy and food (Friend and Blake, 2009). In doing so the impacts on fisheries are not denied but minimised due to assumption that there are viable alternative sources of food (Belton et al., 2014). We argue that to understand this policy neglect and the apparent acceptance of such dramatic losses to food security because of hydropower development, we must place fisheries in the wider context of food systems change (Arthur et al., 2022).

The policy neglect of capture fisheries is a critical concern. Across the region rural people have been highly dependent on localised food systems in which rice, fish and other wild sourced foods play a key role (Lynch et al., 2016; Arthur et al., 2016). Fishing has been central in rural livelihood strategies that combine fishing with farming and collection of wild foods (MRC, 2021). Fishing activity is highly seasonal as species and the environment change with the annual flood cycle (e.g. Deap et al. 2003). Tenure arrangements can also change seasonally, enabling people to fish in flooded rice fields at critical times (Freed et al., 2020). Fish are eaten fresh, smoked or fermented, providing nutritional benefits at times of the year when people may be less able to fish. Informal reciprocal exchange and social networks enable those unable to fish to also benefit (Garaway, 2005). Fish and fishing also provide important safety nets against crop failures, preventing impoverishment (Meusch et al., 2003), and are also of high cultural significance (So et al. 2015).

Drawing on theories of political ecology regarding the power dynamics of social-environmental relations (Svarstad et al., 2018), we expand the analysis of the threats to inland capture fisheries from hydropower by placing them in the context of food system change. A political ecology framing highlights four interrelated axes through which food system change is shaped and through which these dynamics can be analysed: 1) actors and power; 2) discourse and narratives; 3) access to and control over productive resources, and; 4) institutions. This approach offers a corrective to discourses associated with the water-energy-food (WEF) nexus, which tend to take a managerial and technical perspective, with little acknowledgement of power dynamics and social dimensions (Siakwah and Torto, 2022; Wiegleb and Bruns, 2018). \

The politically nuanced analysis presented below provides an important contribution to the scholarship that has tended to focus on the characteristics, structure, functioning and outcomes of food systems (Ericksen 2008; Tezzo et al., 2021), rather than on how such food systems are created, sustained and changed. In doing so, we respond to calls for research to address the interplay of structure and agency in food systems (Ericksen, 2008) and for fish to be recognised as food in policy discourse (Nowell et

al., 2021). Additionally, this perspective provides fresh insight into the case of the Mekong and inland capture fisheries more generally.

The Internal Dynamics of Food System Change

The concept of food systems has been used as a means of incorporating all elements of food production and consumption under a common framework. The food systems literature illuminates the connections between food production, supply chains, retail and consumption, highlighting the complex inter-linkages, dependencies and feedback loops across networks of production and consumption at multiple scales (Ingram, 2011), and the interactions between varied social and environmental variables (Ericksen, 2008). Other literature addresses the diverse consequences and outcomes of food systems, for example in terms of nutrition or environmental sustainability (Bene et al., 2019; Tezzo et al. 2021). Yet despite recognising actors and institutions as components of food systems, the literature has struggled to accommodate the processes through which food systems are actively shaped, and how social, economic and environmental benefits and costs are created and distributed across people and places (Tendall et al., 2015). Where food systems framing has been applied to fisheries, there has been a tendency to consider fisheries and aquaculture as discreet food systems in their own right (Simmance et al., 2022; Tezzo etal. 2021), rather than as parts of wider, changing food systems (Arthur et al., 2022).

Our starting point is the processes by which food systems are changed (Bene et al., 2019). We adopt political ecology insights to consider the power dynamics of social-environmental relations around agriculture and food (Galt, 2013; Blaikie, 2008). We draw from analytical approaches to institutional and policy change (Shore and Wright, 1997; Liefferink, 2006; Ostrom, 2007) that present food systems change as shaped by processes of negotiation, contestation and cooperation. The framework is structured around the four axes of change: 1) actors and power; 2) discourse and narratives; 3) access to and control over productive resources, and 4) institutions.

The first axis highlights actors' values and interests and their respective power and agency as drivers of food systems change (Long and Long, 1992). **The second axis** in turn highlights the role of ideology, discourses and narratives that legitimise and delegitimise the interests of certain actors in systems change (Hajer and Versteeg, 2005; Schmidt, 2008; Schmidt, 2010; Schmidt, 2011; Huitema et al., 2011; Roe, 1994; Verweij and Thompson, 2006). **The third axis** reminds that patterns of access to and control

over key productive resources are also involved in systems change (Ribot and Peluso, 2003). Finally, **the fourth axis** draws attention to the significance of formal and informal institutional arrangements that mediate access and control to resources (e.g.Ostrom, 2007).

This c framework enables us to consider the human dimensions and dynamics of food system change explicitly. Without this more politically nuanced approach, food systems analysis risks reinforcing assumptions that changes in food systems are simply emergent properties of the systems themselves. The framework draws attention to the way in which food systems are contested and who is gaining and losing in terms of the types of food that are produced, their availability and their contribution to health and wellbeing. It thus provides us with a structured way to explore how livelihoods of small-scale fishers as producers and consumers of food are affected by processes of change, and the environmental and human opportunities and costs of producing, supplying and consuming these foods – the transforming structures and processes of sustainable livelihoods (Natarajan et al. 2022). Focusing the analysis on these axes can help reveal how, and in whose interests, changes in food systems are shaped, and importantly, how they might be contested.

The Case Study of Hydropower and Fisheries in the Mekong: the interplay of narratives, resources, actors and institutions within food systems change

We apply the framework of four axes of food system change to examine the tensions between hydropower and inland capture fisheries in the Lower Mekong Basin as a case study of food system change with global resonance. The Lower Mekong Basin is one of the most extensively researched inland capture fisheries. The basin is a hugely productive fishery, estimated to yield some 2.32 million tonnes annually (So et al. 2015), accounting for around 20 percent of global inland fish catch (FAO, 2020), with per capita freshwater fish consumption (42 kg/person/year) among the highest in the world. A wide body of research identifies hydropower as the greatest threat to fisheries productivity(e.g. DHI 2015; MRC 2016; Winemiller et al., 2016; Golden et al., 2019; Ainsworth et al., 2021; Campbell &

Barlow 2021; Soukhaphon et al., 2021). Recent assessments suggest that fisheries productivity will decline by 40-50% (particularly in Cambodia and Vietnam) as a consequence of the planned mainstream hydropower dams (DHI, 2015; MRC, 2016). Ainsworth et al. (2021) argue that the implications of increasing human population and decreasing fishery production could make up to 48 million people nutritionally insecure or nutritionally deficient. In addition, Golden et al. (2019) estimate that there could be 2.2 million people in the region at risk of protein deficiency by 2030. Despite these alarming warnings and recommendations for a moratorium on dam development by studies conducted under the auspices of the Mekong River Commission (ICEM, 2010), all the planned dams are going ahead, and many have already been completed (MRC, 2020). The region faces additional threats to food security, with population growth and high vulnerability to climate change (Allison et al., 2007).

Significantly, the straightforward causal relationship between hydropower development and reduction of fisheries productivity is not challenged. However, policy has paid little attention to addressing the implications of the anticipated losses in fisheries productivity to livelihoods, health and wellbeing (but see Orr et al. 2012). Development policies, including in the United Nations Sustainable Development Goals, frequently omit reference to inland capture fisheries (Lynch et al., 2020; Elliott et al. 2022). Instead, the policy assumption remains that the expansion and intensification of aquaculture, agriculture and livestock will compensate for inland capture fisheries losses, and the dependence of poor people on fishing is turned into an argument that people are poor because they fish (cf Friend et al., 2009). In this way, a narrative emerges of such substitutions as being desirable and inevitable.

Emerging Food Systems

In this section we use the inter-related axes of change – narratives, actors, institutions, and resources – to analyse the drivers and of emerging food systems and their likely implications. However, because the factors in the axes of our framework are intertwined and combine to affect food system change, we offer a synthetic account of food systems change in the lower Mekong rather than axis by axis analysis.

Shifts in fisheries need to be placed in the wider context of agrarian change and planned economic transitions. Across the Global South, the dominant development policy narrative argues that

transitioning from agrarian economies towards industrialisation and manufacturing is necessary for economic development and progress. In Southeast Asia, hydropower development has been central to ambitions for economic growth (e.g. Yoshida et al., 2020). In the debates about hydropower development in the Lower Mekong Basin, the potential impacts on capture fisheries and fisheries productivity have not been denied, instead the focus has been on the scale of impact and the feasibility of mitigation measures (Dugan et al., 2010; DHI, 2015; Winemiller et al. 2016).

The prevailing policy narrative for food and agriculture is also important in shaping the debates around capture fisheries. Here the key narrative is underpinned by notions of modernisation and industrialisation, most clearly manifested in Thailand's 4.0 development strategy. From the economic development point of view, dependence on inland capture fisheries and small-scale agriculture are barriers to progress. Large-scale agriculture, production of cash crops, an emphasis on the role of markets and changes to food retail, reinforce changes to the production and provisioning activities. Despite this, Reisch et al. (2013) argue that the structure, institutions and operation of modern industrial food systems are often invisible to consumers and policy makers alike. Yet these changes have important consequences: industrial food systems characterised by corporate concentration, farm-scale intensification, mechanisation and a "*cost-price squeeze*" have led to *"a decrease in ecological and economic diversity, a high degree of spatial and organizational connectivity, and a diminished decision-making capacity for individual farmers*" (Rotz and Fraser, 2015, p. 459).

Vested commercial interests are actively shaping food systems change. As the most influential player in the region, Thailand's agriculture and food sector represents a model to be emulated by its neighbours. National policy has been influenced by multinational companies such as Charoen Phokpand (CP), a Thai conglomerate. Companies like it purposively apply a model of food systems to their own business strategies. The CP corporate website explains its engagement in all stages of the food system as an "integrated business" model ((https://www.cpfworldwide.com/en/about/vision - accessed 7 December 2022). From its original focus on feed for agriculture and aquaculture, the CP Group has expanded to food production, processing, retail and catering through a network of convenience stores

and restaurants, under the slogan of "Feed, Farm and Food". The dramatic growth and expanding reach have also enabled the company to move way beyond food into property and technology businesses, particularly targeting the Mekong region.

Reflecting the prevailing narrative, commercial interests such as those of the CP have had a privileged seat at the policy table and benefited from tax breaks that have supported the expansion of their contract-farming business model (Chiengkul, 2017). Under this model, investors improve funding and market access and provide new technologies to farmers, while farmers provide water, land and labour (e.g. Xing, 2013). In this model, farmers lose control over key production decisions and assume a role as 'propertied labourers' (Watts, 2000).

A critical feature of the changes in food systems has been a shift in institutional arrangements and associated power structures, relationships, and behaviour. The new institutional arrangements restrict access to resources at the local level and create new relationships between producers and markets, for example in the form of exclusive agreements between producers and investors. Patterns of production are shaped by these market relations. For small-scale farmers in the Mae Chaem district in Chiang Mai, Thailand, there has been a dramatic uptake of corn production for animal feed, facilitated by a complex network of brokers and mill agents that ultimately feed into the production of the two main agri-businesses in the country, as part of a wider shift in global demand for poultry and pigs (Watcharasakonpong, et al., 2016).

Similar patterns pertain to fish and aquaculture. CP initiated contract cage farming of tilapia and production has risen rapidly, with cage-raised fish becoming the most significant source of tilapia in northern Thailand (Belton et al., 2009). In 2011, contract farming amounted to over 70 percent of cage cultured tilapia in parts of northern Thailand (Lebel et al., 2013). In addition to providing inputs, agribusiness firms working through their brokers and agents are an important source of knowledge. When starting production in a new area, firms often form farmer working groups and provide training (Lebel et al., 2013). Support continues through the production cycle with agents visiting farmers to provide advice. Responsibility for extension has thus shifted from public to private actors, creating new

relationships between the firms, their agents and producers. Aquaculture expansion has been supported by government-backed loans to smallholders. This enables them to access finance and new technologies, important factors contributing to commercial success (Lebel et al., 2013).

Further momentum for the development of agroindustry comes from national policies emphasising technological modernisation across production and processing and targeting international markets (NESDB, 2017). Contract farming is central in national development plans and a mechanism for alleviating poverty among farmers in Lao PDR (Fullbrook, 2011). However, contract farming and fishing can significantly change food systems, including the technologies, relationships and the environmental and social impacts. These changes can create risks for producers who may become dependent on the companies for inputs, technology and marketing, affecting what is produced and how. Fulbrook (2011) also notes that, to prosper, smallholder farmers in Lao PDR need to produce higher-value crops for wealthier markets or develop relationships with investors within those markets.

Within increasingly globalised food systems there are also important issues of scale. Shifts in diets in distant urban centres drive production in politically and spatially remote locations. The animal feed corn produced in the Mae Chaem district feeds a growing market for pigs and poultry across the world (Blake et al., 2019). Aquaculture in the Mekong region is similarly serving consumers in regional and overseas urban centres (Tezzo et al., 2021). These changes have implications for the producers as well. In Mae Chaem, animal feed corn production is increasingly associated with high incidence of debt and a recent shift has seen producers not only losing control over decisions concerning production, but also being brought into global food systems as consumers of the food products into which their production has fed (Blake et al., 2019).

Against this backdrop of changes in food systems combined with predictions of potential losses in capture fisheries production due to dam construction in the Lower Mekong Basin, there have been attempts to quantify the implications of potential substitutes. These include fish from aquaculture, livestock (e.g. chicken or pigs) and crops (e.g. Lymer et al., 2016; Funge-Smith, 2018; Golden et al., 2019; Ainsworth et al., 2021). The results suggest that, under current hydropower development

scenarios in the Lower Mekong Basin, land and water resources are insufficient to replace losses in fish protein and nutrients (Funge-Smith, 2018).

Any alternatives require an expansion of cultivated land and an increase in water use (Orr et al. 2012). Replacing fish production with livestock would require 76 to 135 percent more pastureland and it would have important implications for water infrastructure, greenhouse gas emissions and nutrient cycles (Lymer et al., 2016) Such a transition would only be viable at a scale beyond the reach of small-scale farmers. Even aquaculture would require a 1.5 to 3.1 times increase in the inland water area (Lymer et al., 2016); an expansion that is simply beyond resource availability. There are also additional institutional obstacles, including effective land use zoning, credit provision, veterinary support, and market access (Phonvisay et al., 2016). The need for land use zoning reflects the fact that land is already owned and in use.

Producing alternatives also needs to be considered in the context of intensifying conflicts over land and patterns of dispossession. This is especially significant when considering the role of livestock as an alternative source of animal protein. Thailand provides important insights with the enormous growth of Thai agri-business multinationals expanding the livestock sector and global markets. Much of the land used for animal feed corn cultivation in Thailand is in marginal, poorer regions of the country where land titles are insecure, and economic and physical remoteness combine to limit opportunities for crop production. Mae Chaem district again exemplifies many of these issues (Blake et al., 2019). Dramatic increases in feed corn production since 2008, driven by large Thai agri-businesses, has led to increased stubble burning which emits high levels of PM 2.5. In March 2021, Chiang Mai was recorded as being the third most air-polluted city in the world (Tanraksa, 2021).

Alternatives also have implications for the use and consumption of fish. Aquaculture promotion has been central in national agriculture development policies and production has grown significantly in Cambodia, Thailand and Vietnam. However, this is not a simple substitution of like-for-like. Farmed fish may be less nutritious than wild fish (Belton and Thilstead, 2014) and increased aquaculture does

not necessarily provide fish for nutritionally vulnerable people (Bush, 2008; Belton et al., 2014). The relationships associated with new production and provisioning arrangements may also preclude informal reciprocal exchange and social networks that have facilitated access to wild-caught fish in the past (Tezzo et al., 2021). Additionally, the demands for feed and dependence on limited species make aquaculture less resilient to external shocks (Howarth et al., 2013). While aquaculture has a potential role in food systems, it cannot substitute capture fisheries (Funge-Smith, 2018; Friend and Funge-Smith 2002).

Common to changes in food systems resulting from modernisation and industrialisation is the loss of control over decisions about agricultural production, and loss of access to common pool resources, such as capture fisheries (Arthur et al., 2022; Friend et al., 2019). Crucially, any substitute is replacing something that is already present in the diet and frequently available at low cost to the harvester. Thus, what is potentially lost is access to food by the rural poor, not simply in terms of quantities of food but also in terms of locally appropriate food products. Ultimately, this is a redistribution of access to and control over key productive resources that is shaped by vested interests, and that has wider social and environmental implications.

In response to threats facing the Mekong fisheries, counter-narratives have emerged across a range of development actors, pursuing an alternative vision of food systems, but also of fisheries relationship to rural livelihoods (particularly of the poor) and their central place in human-environment relations. In the counter-narrative, inland capture fisheries are a particularly efficient producer of food, with a far lower resource-use footprint than other alternatives (Funge-Smith, 2018).

Conclusion

A systems perspective grounded in political ecology enables consideration of how food systems change, why they change in certain directions and not others, and whose interests are served by these changes. This perspective reveals how policy neglect, projected decline of capture fisheries in the Lower Mekong

Basin due to hydropower development, and shifts in food production play into the processes of creation, contestation and negotiation within food systems. Industrial food systems that privilege production and notions of economic efficiency over diversity should be contrasted with pre-existing more localised food systems that are more agro-ecologically complex, adapted to the local cultural and ecological context, and involve shorter chains between producer and consumer (e.g. Pretty, 2002). These more local food systems, of which inland capture fisheries are a feature in the region (Arthur et al., 2022) are noted for their sustainability, equity and resilience to external socio-ecological shocks (e.g. de Schutter, 2014), but are threatened by the economic and political forces that promote, subsidise and benefit from the expansion of industrial food systems at regional and global scales (McMichael, 2005).

The decline of inland fisheries is much more than a loss of a particular resource or food type. The projected decline of these capture fisheries has become a necessary, inevitable transition to industrial, globalised agri-systems. Enduring narratives of inevitability of such declines and the desirability of industrially farmed food, come together with the interests of networks of commercial and political influence that cross business and government. Such constellations of political and commercial interest shift patterns of access to and control over productive resources that are manifest through new structures and relations in which producers and consumers are caught. Much of the negotiation that influences these changes are in spaces that are not open to all, and actors, particularly small-scale fishers and farmers, may also be deliberately excluded from decision-making.

The food systems framework also reveals that this is not simply a story of fisheries. With hydropower and associated development proceeding, despite knowledge of their impacts on those dependent on existing inland capture fisheries, and inadequate mitigation measures, the loss seems somehow acceptable within policy circles. This apparent acceptability cannot be seen solely from the perspective of fisheries, or debates about substitution of one food for another, but need to be placed in the much broader context of food system change. Challenging this current trajectory, therefore also requires shifting our frame of reference, moving the debate away from the fish and the narrow confines of

impacts, mitigation and substitution. Drawing on the four axes of change presented here provides both a basis for critical analysis and creating alternative policy arguments and interventions.

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