Stormy Weather: Democratizing Expertise in a Changing Climate

Essays on environmental knowledge and social vulnerability in Mexico and India

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Declaration

I certify that the thesis I have presented for examination for the PhD degree of the London School of Economics and Political Science is solely my own work.

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Abstract

This set of essays expands knowledge about climate change governance by analysing how local people influence expertise about storms. This is motivated by the projected intensification of climate change and its disproportionate effects on marginalized people in the so-called Global South, together with the frequent irrelevance of expertise to those who depend upon it most, even when they are included in processes of knowledge production.

The papers draw on debates from three literatures: the politics of expertise from Science and Technology Studies (STS); participation from Development Studies; and vulnerability from Disaster Risk Reduction (DRR). The main contribution of these papers is to expand what we mean by inclusion in knowledge production – that it is not merely the integration of diverse actors, but how political structures shape what knowledge gets heard and who is seen to be producing it – and apply it in conditions of climate risk governance.

The papers describe research in four localities in Mexico and India where marginalized fishing communities are vulnerable to storms, and different configurations of risk, local vulnerabilities, and political cultures offer grounds for comparison. Ethnographic research methods including interviews and participant observation carried out in 2018, 2019 and 2020 were used to gather material which was subjected to discourse and content analysis.

The papers argue that political orders, fisher identities and knowledges are interdependently constituted. The essays add to debates about the democratization of climate expertise by analysing the underexplored effect of expertise as a contested form of politics for climate change adaptation, thereby suggesting ways that development in the context of climate change can better reflect the needs of local

people. The papers contend that making climate policy more relevant and useful requires not just including vulnerable people but understanding how their capacity to shape expertise is embedded in contemporary politics.

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Introduction

The problem of climate expertise

"People and the planet are getting clobbered by climate change" noted António Guterres, secretary general of the United Nations upon publication of the latest report from the Intergovernmental Panel on Climate Change (IPCC). The report (IPCC 2022) predicts increasingly forceful and frequent extreme events "cascading across sectors and regions" (IPCC 2022) prompting fears that "no one can escape climate change" (CNN 2019). Yet scholars increasingly recognize that this "global" warming will have unequal impacts on the world's diverse populations; that it is socio-economically and politically marginalized communities both within and between states that will be disproportionately more at risk from the effects of climate change – as indeed they already are (Ribot 2014; Blaikie et al 2004). This has led the United Nations (UN) to warn of a "vicious cycle" whereby initial inequalities cause greater suffering among disadvantaged groups only to increase these disparities further (Islam and Winkel 2017: 1).

Climate expertise – that is, climate knowledge that is socially authoritative (Jasanoff 2004, 2005; Joly 2012) – plays a crucial role in this sobering picture. Expertise about environmental risk creates the world in a particular image, opening up and closing down different possibilities for living (Andersson and Westholm 2019; Jasanoff 2015; Lovbrand et al. 2015; Paprocki 2022). Such legitimate and powerful forms of knowing are often associated exclusively with the science of institutional bodies, yet there is increasing recognition that local people are also involved in the creation of expertise (Wynne 1996; Tubridy et al 2022; Jasanoff 2005). This is particularly the case in adaptation to climate change, which increasingly emphasises

the need to address “the locally and contextually specified nature of climate change vulnerability” (Ayers and Forsyth 2009: 26).

Yet climate policy has faced challenges, with much concern over its apparent incapacity to address the needs of those most vulnerable to the effects of global warming. Indeed, a growing body of research on “maladaptation” has highlighted strategies that not only fail to meet people’s needs but “create conditions that actually worsen the situation” of vulnerable people (Schipper 2020: 409; Magnan et al 2016). Moreover maladaptation frequently only becomes evident years after a policy has been implemented, with critical long-term consequences for social and economic development (Eriksen et al 2021). These concerns raise at least two questions: how climate expertise can be made more relevant to those who depend on it most? And how can local expressions of climate risk from vulnerable people become part of climate expertise? Yet these questions prompt various challenges.

Just let the science speak?

The first challenge lies in what constitutes useful, relevant knowledge. Much work seeking to improve the utility and relevance of climate expertise has sought to amplify scientific facts so that they can better “speak truth to power”. Scholars have identified this approach – sometimes called a “linear model” of expertise (Beck 2011: 297) – in governments such as the UK’s pledge to “science-based targets” (Sharma 2021) and in the IPCC’s commitment to establishing “sound” scientific facts before they can have “an immediate, direct impact on policy” (Beck 2011: 298). It also manifests in social movements specifically seeking to represent the needs of marginalized groups: the key message of Greta Thunburg – one of the most prominent activists for the climate rights of vulnerable people – to “listen to science” reflects a

deep conviction that more science is the key to fair and impactful climate policy (Jasanoff 2021: 2).

Yet the linear model has been criticized by work in social studies for assuming that climate science presents a politically neutral and universally relevant representation of the problem. Longstanding research has shown that all knowledge is shaped by the socio-political context of its production and reception (Latour and Woolgar 1979) suggesting that climate science might not always travel easily to different socio-political locations (Wynne 2010). This means louder and louder reiteration of scientific "facts" is unlikely to bring about social change (e.g. Merton 1974; Bush 1945; Jasanoff and Wynne 1998; Wynne 2010). Rather, this "deficit approach" to science communication has been shown to reify socially exclusionary expertise by representing some needs to the exclusion of others (e.g. Beck 2011; Beck et al 2014). Furthermore, since it is local experience that gives knowledge meaning, attempts to erase local specificity have become "an important source of the conflicts that have arisen around climate change" (Jasanoff 2010: 235; Beck 2011; Mahony 2014).

The dispute between the Delhi-based Centre for Science and Environment (CSE) and the Washington DC-based World Resources Institute (WRI) in the early 1990s encapsulates these concerns in ways that have only exacerbated since. Responding to the WRI's claim that developing countries such as China and India were among the top global emitters, CSE activists argued that scientific representations of the risks and responsibilities of global warming should distinguish between the "luxury emissions" of the rich and the "subsistence emissions" of the poor, between "per country" and "per capita" levels of greenhouse gases, and between historic and present levels of pollution – all of which would confer greater responsibility

on industrialized countries than existing IPCC science. CSE's report, *Global Warming in an Unequal World* (Agarwal and Narain 1992) argued that while the simple scientific facts of climate change gave the impression of urgency and responsibility, they masked a political game of the North avoiding responsibility for its contribution to climate change and packaging these agendas as facts.

Including local people in knowledge-production

In response to these concerns scholars and practitioners are increasingly turning to participatory knowledge production to make climate expertise more relevant and meaningful to local people (Hügel and Davies 2020; Turnhout et al. 2020). Instrumental knowledge co-production – "the collaborative process of bringing a plurality of knowledge sources and types together" (Armitage et al: 996) – is a particularly popular approach that seeks to "enhance usability of science for decision making" (Dilling and Lemos 2011: 680). It has been called "the 'gold standard' of engaged science" and is increasingly seen as "a panacea to overcome barriers of knowledge use, such as lack of credibility, legitimacy and relevance" (Lemos at el 2018: 722). Indeed, knowledge co-production has even been regarded as a way to "reconfigure the meaning and trajectory of development" (Pelling et al 2011: 167) as well as a means to deliver both procedural and distributive climate justice (Tubridy et al 2022). As Wyborn et al (2019: 323) note, "there are great expectations embedded within current conceptualizations of co-production".

Yet frequently these expectations have not been met. Scholars note that so-called participatory knowledge interventions have often failed to disrupt existing ways of knowing climate risk, even sanctioning dominant expertise by lending it a veneer of procedural legitimacy (Cooke and Kothari 2001; Turnhout et al 2019). Such outcomes

not only decrease trust in expertise but leave vulnerable people even more excluded from the climate knowledge that governs their lives, risking more inappropriate and maladaptive interventions (Eriksen et al 2021). Given the growing popularity of knowledge co-production, understanding these effects is critical.

For many scholars, the problem is to do with how participatory methods are often carried out in naïve, ritualistic ways that channel and reflect historic structures of power such as colonialism (Cooke 2003; Cooke and Kothari 2002). Much research has examined how such structures shape environmental knowledge production filtering what ways of knowing can prevail (Fischer 2003: 28; Stripple and Bulkeley 2013; Li 2007). The issue here is not with participation per se, but whether the methods that are frequently used sufficiently engage with how existing political structures shape interactions between participants and therefore the extent to which they can "allow discourses to speak for themselves" (Peet and Watts 1996: 34).

In response, various scholars have urged more focus on how and where power is held in participation, such as sources of funding, to mitigate the disproportionate resources of (for example) large NGOs and government bodies compared with local marginalized groups (Mitchell et al 2015) and their impact on formal expertise such as epistemic communities. Yet it is not clear that the causal link between greater resources and knowledge outcomes is so direct or linear – or sufficient to address how politics shapes participation. Others have argued that "tackling the power dynamics inherent in knowledge processes" requires "deliberating adaptation alternatives and opening up space for the contestation of predominant development choices" (Eriksen et al 2021: 10). Yet social scientists have questioned the extent to which deliberative methods do not themselves reflect and channel existing politics (Fischer 2000; Turnhout et al 2014) thereby repeating many of the concerns surrounding instrumental

approaches to integrating diverse actors. Such tautologies indicate a need for a more dynamic approach to understanding the less cognitive interactions between politics, knowledge and agency in knowledge production.

Dynamic approaches to knowledge production

Work inspired by social studies of science has been useful here. Rather than seeing expertise as a direct reflection of nature's universal truths, or a continuation of historic structures of domination, the concept of interactional co-production indicates both the socio-political underpinnings of expertise and simultaneously how that expertise "loops back around" to shape the socio-political order (Jasanoff 2004: 3). This "production of mutually supporting forms of knowledge and forms of life" (Jasanoff 1996: 397) thereby indicates less cognitive and linear interactions between knowledge, agency and politics. Scholars have noted that these interactions shape the "*subjects* (publics), *objects* (issues), and *models* (political ontologies)" of participatory interventions in hidden ways (Chilvers and Kearnes 2019; Marres 2012). As such these interactions indicate the less visible and less conscious influences on who gets included and what knowledge gets heard through consultation.

Scholars within Science and Technology Studies (STS) have explored these less cognitive political influences in more detail through concepts such as civic epistemologies (CEs) and discourse coalitions. CEs have been defined as "the institutionalized practices by which members of a given society test and deploy knowledge claims used as a basis for making collective choices" (Jasanoff 2005: 255). Scholars have used the concept to examine how unseen politics filters the visibility of actors and issue framings by generating culturally specific criteria for epistemic authority (Miller 2008; Haines 2019). Discourse coalitions (DCs) refer to hidden shared

discourses between diverse political actors that raise the visibility of problematic framings of environmental phenomena. They show how latent political discourses shape policy outcomes in hidden ways. Scholars have used these concepts to examine how non-cognitive political structures constrain and enable the agency of actors and knowledges by lending them political authority in unexpected and unseen ways.

At the same time there are significant gaps in our understanding of the non-cognitive effects of CEs and DCs, and interactional co-production more broadly. On one hand, research has tended to focus on the national scales of industrialized democracies; yet more work is needed to understand how co-production happens and with what effects in the sub-national scales of non-industrialized countries, and where democratic institutions are patchy and contested (Haines 2019). At the same time, scholars have called for greater attention to how co-productionist processes influence how societies respond to climate risks. For example, Iles (2007) argues that “much remains to be done in developing civic epistemology as a lens through which to understand environmental policymaking” (Iles 2007: 373).

Democratizing expertise

These debates and concerns highlight the need to *democratize* climate expertise – that is, for politically authoritative knowledge that is more inclusive and representative of the needs and voices of vulnerable people. Yet what does *inclusion* mean when instrumental processes of integration are inescapably shaped by the politics that these processes seek to address? What does it mean to *represent* actors when their identities are constructed both by participatory frameworks and by the broader constitutional relations in which these activities are embedded?

The idiom of co-production has presented a powerful analytic through which to illuminate how political orders and authoritative knowledges continually interactionally shape one another. In directs us to “ordering instruments” of institutions, discourses, identities and representations though which joint visions of nature and desirable orders are enacted (Jasanoff 2004: 22). Yet what agency do politically marginalized people have in these processes of making socio-politics and expertise? Indeed, CEs show how “civics” shape these ordering instruments by producing the norms by which knowledge is judged and validated in democracies, and thereby unconsciously influencing the authorization of expertise. But what do CEs look like where democracy is more patchy or political orders are contested by people who are outside the “civic”?

The four papers presented here seek to address such questions by examining how non-cognitive interactions indicated by concepts such as CEs and DCs shape the co-production of political and epistemic authority in socio-politically marginalized and contested democratic contexts. In so doing they suggest insights for reinterpreting participatory governance to make climate expertise more democratic.

These questions are addressed by examining cyclone expertise in Mexico and India; the reasons for selecting these countries are discussed below. The essays in this PhD pay particular attention to how CEs and DCs affect the capacity of vulnerable and marginalized fishing communities to influence authoritative ways of knowing storm risk, and what this means for understanding epistemic agency in participation. The next sections discuss the principal themes and methodological dimensions of this research: storm governance, the vulnerability of fishing communities to these events, the selection of Mexico and India as study sites, and the methods of analysis.

Key themes and methodologies of this work

Storm governance

Storms are projected to escalate in frequency and intensity (IPCC 2022) critically impacting the at least 10% of the world's population who live in densely settled lowland coastal areas (McGranahan et al 2007). In 2021 alone the five highest magnitude storms caused an estimated US$94.5 billion and resulted in more than five hundred deaths (Kramer and Ware 2021). Yet the unacknowledged contested politics of storm expertise is frequently a source of controversy.

First, there remains a persistent concern around the dominance of a "hazard paradigm" in governments, often characterized by a focus on technical solutions to bio-physical risks (Gaillard and Mercer 2014: 93; Hewitt 1983). The worry is that this approach depoliticizes harm and diverts attention away from the socio-economic and political complexities of its causes (Cannon and Müller-Mahn 2010). In response, scholars have proposed the "vulnerability paradigm" emphasizing the pre-existing social vulnerabilities that condition exposure to harm, yet this vision is still "not as effective as it might be in governments" and international organizations (Donovan 2016: 2; Gaillard and Mercer 2014). Studying the interactional co-constitution of risk knowledge and political order can inform both on the persistence of the hazard paradigm, and how social vulnerability and epistemic agency interact more broadly.

Second, storm risk governance and analysis illustrates a historic conceptual divide between climate change adaptation (CCA) and disaster risk reduction (DRR) which scholars are increasingly seeking to bridge (Mercer 2010). CCA has predominantly been addressed under the United Nations Framework Convention on Climate Change (UNFCCC) while storms have come under the purview of the United Nations Office for Disaster Risk Reduction (UNDRR), despite significant overlap in

theory and policy. Such divisions have reduced the efficiency and effectiveness of responses, and scholars have noted huge potential for better outcomes from cross-learning between these domains (Shackleton and Donkor 2018), yet progress on this has been slow (Dias et al. 2019). Examining the co-production of political and epistemic authority at the local level can show aspects of overlap in these dimensions of vulnerability and how conceptual boundaries become established.

Fisher vulnerability to storms

The vulnerability of fishing communities is an important example of the dynamic interaction of storm expertise, politics and local people. The Food and Agriculture Organization (FAO) estimates that 39 million people are employed in fishing worldwide, mostly in small-scale artisanal practices in developing countries (World Bank 2022). These communities, who often work from the shoreline or small boats make "important but undervalued contributions to the economies of some of the world's poorest countries" (Andrew et al 2007: 227) and contribute much of the animal protein for millions living with food insecurity (UNDP 2005). Yet they also experience a complex interaction of political, economic and social vulnerability.

Fishing communities in developing countries are often multidimensionally poor (Jazairy et al 1992; Béné et al 2009). Most rely upon fishing for subsistence and income but receive minimal amounts for their catch and are vulnerable to fluctuating market prices (Cochrane 2000); additionally they often have negligible access to school, drinking water, healthcare, sanitation and credit (Mills et al 2011). Many also live on coastal lands lacking in reliable systems of land tenure, making them vulnerable to eviction as well as erosion and sea-level rise (Fabinyi 2020). At the same time fishers in developing countries are often socially and politically marginalized, tending

to live apart from the rest of society in separate neighbourhoods with their own distinct culture, norms and social networks, receiving little interest from political leaders (Kurien 1995). As such storm risk is generated through a complex matrix of vulnerabilities that are not encapsulated solely by the bio-physical risks of wind, water and waves.

At the same time, small-scale fishers have challenged official environmental risk expertise. For example, the global movement of small-scale fishers, the World Forum of Fisher Peoples (WFFP) contested the FAO's omission of fish from its definition of "food security" and highlighted the role of "ocean grabbing" in climate vulnerability (World Fishers Org 2014: 5). It also formally challenged the World Bank's drive towards "rights-based fishing" as a solution to threats of pollution, ocean acidification and climate change for allegedly excluding fisher peoples from access to the sea (World Fishers Org 2014: 24; 2013). Like the CSE, the WFFP disputed the apparently universal and objective science of global knowledge institutions to capture the realities of the causes of environmental degradation and reflect environmental justice in its policies.

Meanwhile various studies have examined the distinctive and prolific traditional expertise of fishing communities through which fish migratory patterns, currents and weather conditions are known and responded to (e.g. Deepananda et al 2015; Vásquez-Carrillo et al 2021; Thornton and Scheer 2012). Scholars of DRR and CAA increasingly regard "local skills, tools, techniques, wisdom, beliefs and customs" as key to successful adaptation to climate change (Inaotombi and Mahanta 2018: 1; Jahan et al 2014) and weather prediction (Salim and Monolisha 2019: 781). Practitioners have advocated integration of this knowledge into official scientific expertise (Salim and Monolisha 2019), yet this aspiration is complicated by the fact

that traditional fisher knowledge has often *rejected* this official knowledge. For example, many fishers contest an official emphasis on physical safety, often going to sea despite official weather warnings and moving back to their coastal homes after relocation to more robust concrete houses inland (Bavinck et al 2014). This prolific knowledge and its challenge to official expertise together with the marginalized status of many fishers makes examining their capacity to shape the co-production of epistemic and political order during climate change instructive and important.

Sites of research: Mexico and India

This PhD sought to understand how non-cognitive politics such as CEs shape the interactional co-production of political and epistemic authority in storm governance. While case studies have revealed important insights about CEs, there is a need for more comparative examination of these processes as shown by Jasanoff's (2005) comparative study of CEs in Germany, USA and UK. As such, this work sought to continue this comparative approach by examining CEs as less formal norms of citizenship and de facto alliances between local authorities and marginalized people in developing country contexts at the non-nation state level. While not a classic comparative political analysis whereby sites are controlled to ensure only specific variables are different, these locations are nonetheless important for understanding the interaction of authoritative risk knowledge, CEs, storms, development, vulnerability and climate change governance.

India and Mexico were chosen by a three-step process. First, 12 developing countries that experience cyclones regularly and are implementing adaptation

policies[1] were identified (IPCC, 2014**;** WMO). Of these, the five[2] middle-income, non-aid dependent countries were selected, expecting they would be more likely to have independent epistemic characteristics, rather than being informed by the conditionality of their aid, or the epistemic approach of global aid institutions. Of these, the selection of India and Mexico was influenced by personal reasons: I speak Spanish and had experience working in India.

Table 1 indicates differences in aspects of CEs for each country that provided the starting point for comparison.

Table 1: Differences in epistemic cultures between India and Mexico

Arena of civic epistemologies	**Comparison of epistemic cultures in India and Mexico**
Government	*India* • A history of challenging global expertise that the preservation of the Earth's climate supersedes economic development, and framing climate change more as a problem of the fair allocation of responsibility for historic greenhouse gas emissions (Ghosh 2012; Dubash 2012; Mahony 2014; Stevenson 2011). • For example, India reacted to the IPCC's erroneous prediction of the melting of the Himalayan glaciers by setting up its own national scientific network, the Indian Network for Climate Change Assessment (INCCA) (Mahony, 2014). *Mexico* • Has not challenged global approach that environmental protection and sustainability supersede present economic development. Indeed Mexico was the first developing country to submit its Intended Nationally Determined Contribution (INDC) ahead of the Paris Summit in 2015 and has set ambitious greenhouse gas emissions targets for 2030 that are not conditional on climate finance from developed nations. • Made a joint climate policy task force with the USA to enhance regulatory coordination in fuel efficiency and electricity modernization in 2015, showing that it is keen to work with industrialized countries to reduce emissions.

[1] These were: China, Philippines, Mexico, Cuba, Bahamas, Vietnam, Madagascar, India, Bangladesh, Myanmar, Haiti, Dominican Republic
[2] These were: China, Philippines, Mexico, Vietnam, India

	• Has been a supporter and implementer of policies advocated by the dominant paradigm of climate change expertise and global expert institutions such as the World Bank, most notably, Payment for Environmental Services (PES) (McAfee and Shapiro, 2010).
NGOs	*India* • Indian NGOs have been characterized as "non-compliant" meaning they question development policies and articulate alternative agendas to the state, and are often viewed as a threat to the government, especially at the local level (Townsend et al 2014: 874). Although others have nuanced this view, explaining that they are in an "uneasy partnership" with the state because they accept funding while continuing to oppose their policies (Ray and Katzenstein, 2005). • Historically the master frame of national NGOs has been characterized by democratic socialism, inclusivity, raising the voices of marginalized people and ending inequality, reflected in environmental policy in a concern for "the use of the environment and who should benefit from it; not with environmental protection for its own sake" (Ramanchandra Guha in Ray and Katzenstein, 2005: 11). That said, some scholars have questioned the extent to which this master frame has changed since the embrace of neoliberalism of the early 1990s, pointing to a greater emphasis on individualism and middle class environmental interests (Ray and Katzenstein, 2005) *Mexico* • Unlike India, research suggests that Mexican NGOs are more likely to support the dominant epistemological approach of their funders and orthodox expertise, because they are more dependent upon the support of international organizations and finance (Townsend et al., 2004; Gledhill, 2001). • This suggests that Mexican NGOs are less likely to deviate in their civic epistemologies from the dominant approach of the middle class, state or international organizations, upon whom they depend for their survival, leading Fox and Hernandez (1992: 193) to argue, "most NGOs have been followers rather than leaders".
Civil Society	*India* • Scholars have noted India's dynamic and active civil society, with social movements having played a central role in society since Independence (Ray and Katzenstein, 2005). Environmental movements are typically characterized by a narrative of "environmentalism of the poor" (Dubash, 2009) involving an emphasis on fair distribution of access to natural resources and prioritization of the livelihood needs of socio-economically marginalized groups. *Mexico* • Civil society groups are less prolific in Mexico. Scholars note that labour unions and peasant groups have historically been controlled and

	oppressed by the government, with membership often being obligatory and leadership pre-selected by government officials (with the only exception being the Catholic church) (Fox and Hernandez, 1992). For example, Brysk (2000: 154) argues that labour unions have been "corrupted by the state or ruling party".
Fishing communities	*India* • India's fishers are politically active locally and transnationally, often through membership in trade unions. They have been central to the formation of national and transnational networks such as the National Fishworkers Forum (NFF), the International Collective for the Support of Fishworkers (ICSF) and the World Forum for Fishworkers and Producers (WFFP) (Sinha 2012). They have also engaged in coalition building across sectors through India's National Alliance of People's Movements and have taken part in the World Social Forum (Sinha 2012). • These movements have been highly critical of the government, with some success. For example the NFF forced Keralan government to ban trawling during fish spawning. *Mexico* • In Mexico fishing communities are generally socio-economically organized into cooperatives and permit-holding groups. Cooperatives (usually involving voluntary formal contracts for working collectively to meet common economic and cultural needs) have long been incentivized by government policy (Basurto et al 2013). Yet recent changes in fisheries law to attract foreign investment has enabled individuals to obtain the permits necessary to fish (Basurto et al 2013) creating social frictions. • These cooperatives and permit-holding groups do not appear to politically challenge the state in the same way as their Indian counterparts. Méndez-Medina et al. (2021: 396) note that fishers "often portray themselves as powerless to address collective action issues, and the government is often portrayed as the problem-solver".

Source: author

This simple comparison indicates that the Indian government has been less accepting of global commons climate expertise than the Mexican; and that NGOs and civil society – including fishing organizations – have been more prolific, active, critical and independent in India than in Mexico. This suggests diverse political-epistemic interactions between state and society in the production of CEs between the two countries.

Within India and Mexico, four sites were chosen: Yucatán and Puerto Escondido in Mexico and Kerala and Odisha in India. They were selected because their diverse socio-political contexts indicated potential differences in the co-production of risk and political order. The following table outlines these differences. While Yucatan has a recent history of cooperation between state and federal agencies for climate change policy, Oaxaca does not exhibit these tendencies (UNDP, interview) and is governed by *usos y costumbres* – traditional community practices legally recognized in 1995 as a result of protests by indigenous groups. This governance structure has reduced the interventionist capacities of the state and coordination and have come to represent the self-determination and autonomy of indigenous groups within Mexico (Mattiace 2012). Civil society is also less challenging of the state than in Oaxaca.

In India, while Kerala has a history of political independence from the Centre, Odisha has been characterized as more conservative in political culture (Bhuiyan 2014; Drèze and Sen 2013). Moreover, Odisha – and the Odisha State Disaster Management Agency (OSDMA) – has been a national leader in the production of expertise about climate risk ever since the super cyclone of 1999. At the same time, Kerala has many more NGOs and a more active civil society – including its fishing communities – than Odisha (Kurien 1995; Kurien interview). These differences suggest diverse influences on the emergence and effects of CEs in these locations.

Table 2: Summary of different epistemic cultures in four states

Arena of civic epistemology	Yucatán	Oaxaca		Kerala	Odisha
Government	Cooperation between state agencies and federal government in production of expertise.	Decentralization (more than 570 autonomously governed municipalities). Rejection of centre expertise (418 municipalities governed by *Usos y costumbres*).		History of independence from Centre; politically socialist and liberal. Only a very recent history of concerted production of disaster expertise.	Conservative in political culture. Leader in production of expertise about disasters for whole country (OSDMA).
NGOs / Civil Society Organizations (CSOs)	Less challenge to government; ranked 1st for civic engagement in country (OECD 2014).	History of indigenous communities challenging government.		Many NGOs and CSOs, challenge government. Fishers of Kerala are most organized and politically active in the country.	Fewer NGOs than Kerala; less challenge to government. Fishers of Odisha are less politically active.

(Mattiace and Ley 2022; OECD 2014; Mattiace 2012; Sanchez, Hinjosa and Wright 2018; Drèze and Sen 2013; Singh 2010: 282; Bhuiyan 2014)
Source: author

Methods of analysis

These essays draw upon ethnographic fieldwork carried out in 2018, 2019 and 2020. This included surveys, focus groups and interviews with fishers as they were going about their daily lives sorting catches and equipment on the beaches at dawn; interviews with government officials about the politics of risk governance over orange squash at disaster management conferences; and sorting policy documents from piles of dusty paperwork in government and trade union offices.

Interviewing offered a way to engage with how fishers and government officials understood and articulated cyclone risks in relation to their democratic contexts (Aberbach and Rochman, 2002). Annex 2 gives a list of people interviewed in this

research. Interviews were semi-structured, involving a skeleton of flexible open-ended questions that allowed for elaboration and deviation (as recommended by Littig (2009) and Goldstein (2002)). This enabled risk meanings and knowledges to be accessed via interviewee languages, phrases and discourses that were not overly constrained by rigid questioning. Surveys allowed comparison across groups of fishers on key questions such as: “what risks and challenges do you face?” and “who helps you most face the risk of storms?” This enabled comparison of CEs in the discourses of fishers across diverse political contexts. Please see Annex 1 for a sample of a survey questionnaire.

A constructivist understanding of documents as “fields, frames and networks of action” (Prior, 2004: 2) was adopted, seeing them not as “neutral, transparent reflections of organizational or occupational life” but rather as “actively construct[ing] the very organizations they purport to describe” (Atkinson and Coffey, 2004: 77). This was particularly useful in this research for understanding how ways of *knowing* risk both constitute and are constituted by the political orders through which they are *lived* – including the practices, artifacts and technologies of government and fisher institutions.

This information was analysed using discourse analysis (DA), which involved examining phrases, metaphors and voices through which risk was articulated, as well as the social and historical contexts in which these articulations were situated (Fairclough 2016). DC reflects the interpretivist approach of this research, in which “it is not [so much] environmental phenomena in itself that are important, but the way in which society makes sense of this phenomena” (Hajer and Versteeg 2005: 176). In this work, DA also captured the fluidity of interactional co-production through which meaning “never solidifies, but is constantly the object of political contestation” (Hajer

and Versteeg 2005: 177). Moreover analysis of discourses was particularly revealing of the relationship between democracy and expertise. On one hand this was indicated by the extent to which discourses were “inclusive, open, accountable, reciprocal” (Hajer and Versteeg 2005: 176). On the other hand, DA indicated how subjects, risk knowledges, actors and politics were interactionally co-constituted, thereby informing upon the extent to which the co-production of epistemic and political authority is inclusive or representational.

The research involved various challenges, none of which have absolute solutions. First, working across different languages presented difficulties in collecting, interpreting and comparing articulations of risk. While I speak Spanish fluently, words represent histories that a foreigner can never fully understand, meaning it was likely that deeper significances relevant to this research were missed. I employed translators in Odisha and Kerala because I do not speak Telugu, Oriya or Malayalam, which is spoken by fishing communities in those locations. Yet often meanings were hard to disentangle. For example, in fisher interviews “climate change” variably signified changes to the weather unconnected to rising greenhouse gas emissions, and a global geopolitical battle for socio-economic justice. Practical measures such as recording and following up on interviews provided some clarity, but interpretive gaps have inevitably become part of the texture of this research.

Second, this research has been shaped by my positionality as a white woman from an industrialized country. On one hand this affected how my interviewees responded to me and my questions: fishers often expected that I could convey their needs to the government, while government actors frequently expected me to share my research with them. I sought to address these expectations by both sharing my

research with interviewees through presentations and discussions, and foreshadowing interviews with clear communication of the goals and limitations of the research.

Yet even so, criticism of “extractivist” research methods raises questions as to the sufficiency of such ethical safeguards and the need for greater reflection upon the politics of gathering and engaging with local information (Liboiron 2021; Dumit 2012; Tuck 2009). Indeed, scholars increasingly note that engaging with epistemologies of the South requires ensuring that “engagements do not simply reproduce colonial forms of appropriation and domination” through “a relearning of method in an anti-piratic way” (Tilley 2017: 27). This might involve including the political histories in which local knowledges are embedded rather than simply taking the aspects that are useful to the researcher; or indeed allowing some information to remain unappropriated (Liboiron 2021). At the very least, studying the knowledges of marginalized actors here has indicated a need for deeper reflection upon how this research contributes to the “Resource relation” of knowledge, power and politics that it, in part at least, seeks to examine and challenge (Liboiron 2021: 125; Vera et al 2019).

Outline of essays

The essays presented here examine non-cognitive processes that shape the co-production of epistemic and political authority in the context of storm governance in Mexico and India, and thereby seek to develop insights for the theory and practice of democratizing climate expertise. The first paper, *How can knowledge co-production democratize adaptation expertise? Comparing storm governance in Mexico and India* compares two different approaches to coproduction – collaborative and analytic – and their implications for making storm governance in Mexico and India more relevant to vulnerable people. It specifically addresses the question of how participatory

procedures can better account for the non-cognitive influences of politics on local agency and knowledge. It shows that the way fisher subjectivities are connected to wider political agendas makes their needs visible in particular ways. It also adds to debates about maladaptation by highlighting the need to engage more with what local people value as adaptive outcomes to understand why adaptive strategies fail.

The second, *Fixing subjects fixing outcomes: Civic epistemologies and epistemic agency in participatory governance of climate risk* builds upon the analysis of the first paper by examining how the concept of civic epistemologies (CEs) can provide insights about how political contexts shape publics and debates in participation. It shows how in storm governance in Odisha, India, CEs influence the interdependent formation of subjectivities (fisher and state) with bio-physical representations of risk, thereby sustaining reductive roles and futures. As such it responds to the question of how epistemic authority and political orders dynamically shape one another in developing country contexts. It also develops the concept of CEs by examining them as performative acts carried out by marginalized communities and state actors at the sub-national level of a non-industrialized country. In this way it indicates opportunities for governing and increasing epistemic agency. This paper is published in *Science, Technology and Human Values*.

The role of CEs in inclusive knowledge production is investigated further in the third paper, *Democracy in a deluge: Epistemic agency amid fractured politics*. This paper responds to the question of how CEs are shaped by groups considered to be marginalized from the "civic" in a context where the political order is fractured. It shows how fishers in Puerto Escondido shape CEs through their expectations of the democratic order and proposes examining CEs as "expectations of democracy" in locations where democracy is highly contested. More broadly, it shows how non-

cognitive interactions between knowledge and politics – indicated by these expectations – condition what understandings of cyclone vulnerability gain epistemic authority. This paper has been submitted to *Environment and Planning E*.

The final paper, *Liquefying nature: Cyclones, epistemic vulnerability and the possibility of alternative life-worlds* examines how the socio-political processes of authorizing climate knowledge might be disrupted to enable alternative futures to emerge. To do so it intervenes in debates about how greater fluidity can be brought to analyses of authoritative climate knowledge based upon assemblages. In particular, it highlights non-cognitive and contingent interactions in configurations of knowledge, politics, actors and objects by drawing upon the concepts of discourse coalitions and interactional co-production. The paper shows how these interactions have shaped the capacity of fishers to influence cyclone expertise in Kerala, India, and also create openings through which alternative ways of knowing risk can emerge. This paper also introduces the concept of “epistemic vulnerability” to refer to how these constitutional interactions influence the (in)capacity of actors to shape climate expertise.

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Can Knowledge Co-production Democratize Climate Expertise?
Comparing Storm Governance in Mexico and India

Abstract

Knowledge co-production is frequently presented as a way of democratizing adaptation expertise by bringing a diversity of knowledge producers together for consultation yet has been criticized for undertheorizing the non-cognitive influences of politics on local agency and knowledge. This paper argues that an alternative, more analytic interpretation of co-production from social studies of science can advance democratization by showing how politics shapes what knowledge is heard and who is seen to be speaking it. The paper illustrates this argument by examining consultative and analytic approaches to co-production in the context of storm risk governance from two comparable sites in India and Mexico. Presenting evidence derived from interviews with vulnerable fishing communities, it shows how narratives of political resistance shape both the identities of local fishers and how they articulate the risks they face. This research is novel for comparing these two approaches to co-production in two sites to draw insights for adaptive policymaking in practice. It shows that democratizing adaptation expertise requires not just consulting diverse users but critically examining how contemporary politics influences how local needs are represented by local people and others. Furthermore, greater understanding of how co-production is shaped by contemporary politics can elicit the social changes needed for more long-term, emancipatory and sustainable forms of adaptation by indicating hidden ways that dominant socio-political orders are upheld.

1. Introduction

A growing concern in recent years has been that climate policy lacks relevance to the vulnerable people who depend on it most, prompting calls to democratize expertise by representing the voices of local people in knowledge production processes (Mikulewicz 2018). Various scholars have underscored the need to "explore differential understandings, knowledges, values and political interests between groups related to what the causes of vulnerability are" (Eriksen et al 2021: 10). One increasingly popular approach is knowledge co-production, often understood as "the collaborative process of bringing a plurality of knowledge sources and types together" (Turnhout et al 2020; Armitage et al 2011: 996). This consultative approach to knowledge co-production (henceforth consultative co-production) proposes "a normative agenda of facilitating the participation of disempowered groups in shaping knowledge production and actual planning processes" (Tubridy et al. 2022: 5**)** to make climate expertise more "useful" and "usable" (Lemos and Morehouse 2005: 65; Dilling and Lemos 2010: 680). This has become a "rapidly spreading practice among scientists, stakeholders and funders", even being seen as "a panacea to overcome barriers of knowledge use" (Lemos et al 2018: 722).

An important application of consultative co-production is in debates about maladaptation to climate change. Maladaptation has been defined as "when adaptation to climate change goes beyond wrong" (Schipper 2020: 413) and refers to instances where attempts to encourage adaptive capacity exacerbate vulnerability and inhibit sustainable development. Such instances have been connected to a "gap between the everyday concerns of vulnerable groups and expert definitions of risk and exposure which typically form the basis for action" (Tubridy 2022: 5). Consultative co-production has been presented as a way of addressing this by "opening up the

ownership of adaptation knowledge to *effectively* include marginalized groups" and as such "key to achieving more inclusive and innovative adaptation interventions" (Eriksen et al 2021: 12; Tschakert et al 2019).

At the same time there have been doubts as to the sufficiency of consultative co-production to represent local people, with some analysts arguing that there are "critical weaknesses in conceptualizations…with respect to power, politics and governance" (Wyborn et al 2019: 319; Turnhout et al 2020; Lovbrand 2011; Nagoda and Nightingale 2017). In voicing these concerns some scholars have drawn upon existing debates in science and technology studies (STS) about a different – analytic – form of co-production, which refers to the less conscious interactions between knowledge and political contexts (Miller and Wyborn 2017; Borie et al 2021; Mahony and Hulme 2018). This work has shown that consultation is affected by non-cognitive political structures, that influence representation by shaping which actors are included and what knowledges gain visibility (Jasanoff 2004; Hilgartner et al 2015; Forsyth 2019; Chilvers and Kearnes 2019).

One example of such structures are "storylines" or "narratives", which have been understood as "devices through which actors are positioned, and through which specific ideas of 'blame' and 'responsibility' and 'urgency' and 'responsible behaviour' are attributed" (Hajer 1995: 64-5). Analysts have examined how narratives order actors into particular roles and identities, rendering complex environmental issues into simplified explanations (Forsyth 2019). For some this raises questions about how non-cognitive politics shapes consultative co-production in hidden ways, complicating its aspiration to represent local needs simply by bringing diverse actors together, yet this work has thus far remained largely theoretical (Miller and Wyborn 2018).

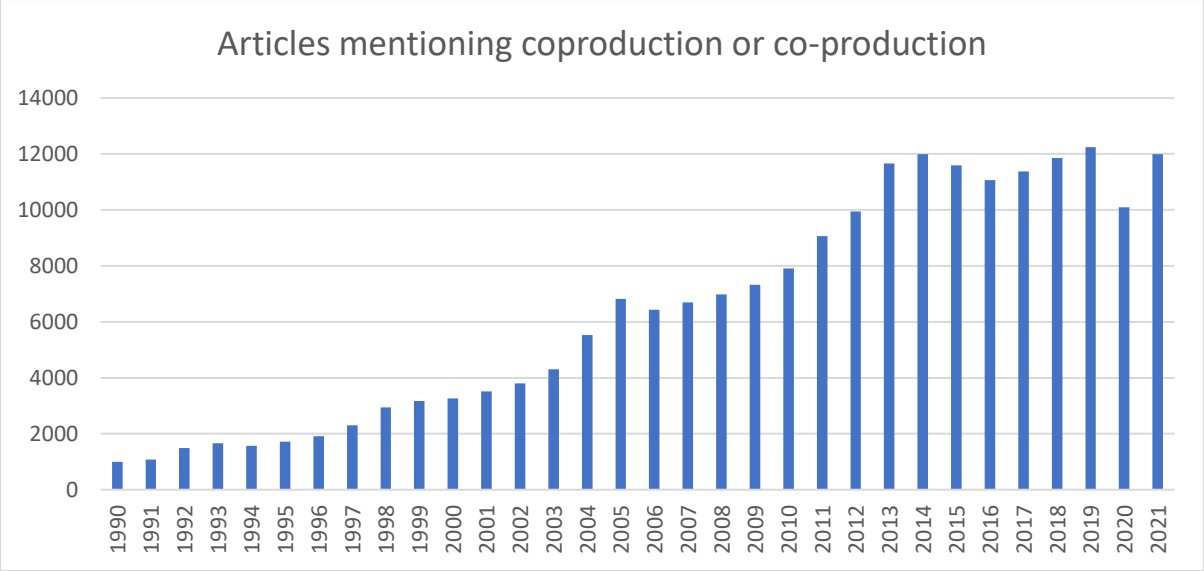
This paper seeks to contribute to democratizing adaptation expertise through co-production by examining analytic and consultative approaches alongside each other in practice, in two different political contexts. This work is novel because there is still a need to understand how contemporary politics shapes the production of climate expertise in practice, and because there has been relatively little work comparing these dynamics that can draw lessons for climate policy. The paper looks at storm governance in Yucatán, Mexico and Kerala, India as arenas of the production of adaptation strategies. It compares narratives of risk articulated by vulnerable fishers in these locations to derive insights about how contemporary politics shapes two key aspects of representation in consultation: the identities of local people, and their visions of risk. As such, this research examines how local actors and knowledges are represented by studying their own narratives: considering how they constitute their identities and what they make visible rather than what others see. The analysis also indicates opportunities for governing the effects of politics on storm risk governance by showing how identities and knowledges emerge and reify political orders.

The next section discusses existing approaches to co-producing adaptation expertise. A brief methodological note follows before the paper presents empirical material of fisher risk narratives in San Felipe and Poonthura. After this the paper analyses how fisher narratives constitute actor roles and knowledges, indicating how contemporary politics shapes who and what is visible. Here the paper also discusses implications of this analysis for governing adaptation. A concluding section examines lessons learned for democratizing adaptive governance through co-production.

2. Theoretical review: Co-production and democratization

2.1 Co-production in adaptative policymaking

Figure 1: Newspaper and academic articles mentioning "co-production" or "coproduction" 1990-2021.



Source: Factiva

Co-production is widely debated and increasingly used (see figure 1) (Lemos et al. 2018). Figure 1 shows a sharp rise in discussion of the term[3] since 1990 with sustained popularity over the last decade. In global environmental policy co-production has generally been interpreted as a deliberate choice to facilitate consultation between local stakeholders and experts. This approach has been called "normative" (Bremer and Meisch 2017; Lemos et al 2018) because it aims to elaborate best practice procedures for how actors *should* produce more democratic knowledge. At the same time, social scientists have argued that all research is "situated" (Haraway 1988: 575) and so it is not clear that this normative commitment is a distinguishing feature. As such, other analysts have referred to "consultative" co-production distinguishing a

[3] Scholars have variably used 'co-production' and 'coproduction' to indicate analytic and collaborative approaches.

practical-procedural focus on bringing diverse actors together to achieve these goals (e.g. Beck and Forsyth 2020).

Consultative co-production has been seen as a way of democratizing climate expertise in at least two ways. On one hand, analysts have suggested that it can empower local actors and voices by "listening to and supporting holders of non-scientific knowledge" (Bojovic et al. 2021: 4) and rejecting "hard distinctions between expert and lay" (Corburn 2003: 423). On the other hand, scholars suggest that joint knowledge production can generate more relevant expertise by "fusing the expertise of scientists with insights from the local knowledge of communities" (Lemos and Morehouse 2005; Corburn 2003: 420).

For many analysts achieving these outcomes requires an "iterative, interactive and collaborative process" of "engagement, involvement and empowerment" combining "multiple participatory approaches and communication tools" (Bojovic et al 2021: 3). This has often been proposed via structured procedures for bringing local knowledge producers together with experts, involving multiple steps for collaboration on knowledge generation, project design and implementation (Reyers et al 2017; Beier 2016; Djenontin and Meadow 2018; Bojovic et al 2021). Figure 2 shows the sequential nature of these processes, their emphasis on transparent rules and on the creation of uncoercive deliberative spaces (Eriksen et al 2021; Taylor 2015).

These aspirations have been reflected in current debates about maladaptation – "a process by which people become even more vulnerable to climate change" (Schipper 2020: 409; Eriksen et al 2021). A key concern here has been the alleged focus of current expertise on technical solutions to bio-physical risks, which are seen as "disconnected from local realities, including people's needs, the cultural fabric and the traditional systems of governance" (Gaillard 2012: 261-2). Consultative co-

production has been presented as a method of closing this perceived “climate gap” between the priorities of experts and “everyday concerns of vulnerable communities” by including local understandings of socio-economic risk (Tubridy et al 2022; Gaillard 2012: 261; Hardy et al. 2017; O’Brien et al. 2007).

Others have hoped consultative co-production can bring about broader societal shifts that “look beyond a programmatic approach to adaptation” (Eriksen et al 2021: 2) to “reconfigure the meaning and trajectory of development” (Pelling 2011: 167). For example recognizing “the plurality and/or diversity of knowledge bases across the world” has been presented as a way of decolonizing adaptation expertise and governance and thereby enhancing social justice (Khan et al 2021: 4). Meanwhile a growing body of work associates consultative co-production with procedural justice by making the processes of knowledge production more inclusive (Corburn 2003; Braun 2015; Holifield 2012; Tubridy et al. 2022).

Yet, other scholars have questioned the capacity of consultative methodologies to represent marginalized actors and knowledges (Wyborn et al. 2019; Jagannathan et al 2020) and as such the extent to which they can bring about social change and justice. Many of the methodologies described above resemble Habermasian principles of deliberative communication and ideal-speech, yet debates in social sciences have questioned the achievability of such conditions (Fischer et al 2015; Fischer 2003). As such it has been suggested that consultative co-production might paradoxically legitimize the existing hierarchies of actors and knowledges that it seeks to disrupt by operating within unacknowledged political structures (Turnhout 2019; Cooke and Kothari 2001). Scholars consequently suggest that “there may be a trade-off between research co-produced to be accountable to the knowledge needs of societal decision-makers, and co-produced research that seeks to challenge and transform existing

ways of thinking" (Lovbrand 2011: 231). Such uncertainties have led some analysts to argue that "the co-production literature has not paid sufficient attention to the role of power and politics in shaping processes and outcomes" (Turnhout et al 2020: 15).

Figure 2: Principles and practices for co-production in climate risk governance

Procedural principles

- Bring together diverse actors and multiple types of knowledge at an equal level ('inclusivity') (Holscher et al 2020)
- Be open to adopting and sharing knowledge throughout the process ('openness') (Holscher et al 2020)
- Include legitimate and trustworthy knowledge ('legitimacy') (Holscher et al 2020)
- Situate the process in a particular context, place or issue (Norstrom et al 2020)
- Define goals and plan implementation collaboratively and transparently (Beier et al 2017; Norstrom et al 2020; Reyers et al 2015)
- Prioritize co-productive processes over stand-alone products such as scientific facts and solutions, through discussion of assumptions, models, data sources and criteria (Beier et al 2017)
- Experts should expect their knowledge to be challenged (Beier et al 2017)
- Experts should evaluate co-production processes which should be reviewed and revised on the basis of these evaluations (Beier et al 2017)

Desired outcomes (Holscher et al 2020)

- Co-produced knowledge should be actionable and immediately translatable into policy and planning
- Knowledge should be usable and empowering so it is adopted by many actors
- Knowledge should connect to various institutions, goals and strategies to create synergies across sectors

Sources: Holscher et al 2020; Norstrom et al 2020; Reyers et al 2015; Beier et al 2017

2.2 Analytic co-production

An alternative, analytic approach to co-production has been useful for scholars addressing such dilemmas. Sociologists of science developed the concept in the 1990s to refer to the way knowledge and political contexts reflect and constitute one another (Jasanoff 2004; Jasanoff and Wynne 1998). This understanding of co-

production has been called “descriptive” on the understanding that it seeks to interpret relations between science and society rather than actively intervene in them (Bremer and Meisch 2017: 6). Yet, it has also sought to democratize environmental expertise but has done so by examining the unavoidable and non-cognitive structural forces that shape the interdependent (co-)production of knowledge and social order, rather than through deliberate cognitive processes of integrating diverse actors (Jasanoff and Simmet 2017). As such, others have referred to interactional or analytic co-production to indicate this analytic approach to democratization (Jasanoff 2004; Hilgartner et al 2015; Beck and Forsyth 2020).

These non-cognitive processes of interactional shaping between political orders and expertise are relevant here because they influence two aspects of collaboration: what actors are included and which ways of knowing are considered important and useful. First, a key insight of analytic co-production has been that, rather than “external pregiven categories”, the subjects of participatory interventions are actively constructed through practices of consultation that are shaped by wider social and political orders (Chilvers and Kearnes 2019: 4). As such, selecting actors for consultation based on visible identities such as indigeneity or membership of a particular community makes assumptions about the autonomy and externality of these categories and hides their connections to wider political agendas as well as heterogeneities and conflicts within them (Wynne 1991, 2006, 2016; Marres and Lezaun 2011). Consequently analysts have called for greater attention to the ways in which consultation “creates conditions where people…are presented in reductive ways” (Beck and Forsyth 2020: 2).

Such processes do not simply refer to the imposition of reductive visions on local people, but deeper, multi-directional processes by which contemporary politics

and identities shape one another. The concept of subjectivities is relevant here. Although widely debated, sociologists have used the concept to examine how actors internalize and perform dominant political codes and norms (Butler 1997) producing "the desire for recognition, belonging and rights" that shapes how phenomena such as environmental risks are experienced and articulated (Nightingale et al 2019: 890). While some scholars of environmental change have conceptualized subjectivities as deliberate positionalities that actors adopt in relation to processes of subjectivation (Pelling and Navarrete 2015) others view them as less cognitive internalizations of the "multiple and intersecting exercise of power within socio-natural networks" (Nightingale 2010: 153). Indeed, for Nightingale (2018) they are a key component of the "socio-environmental state" – the recursive co-constitution of political authority, governed subjects and the agency to define environmental issues (Nightingale 2018). As such, subjectivities capture how people do not have fixed stable identities, but rather are multiple, simultaneous and intersectional (Butler 1997; hooks 1984).

A second insight of analytic co-production is that knowledge – local or expert – does not refer to detachable information, but the meaning that emerges through the interaction between information and contemporary political concerns, such as social justice and livelihood security. For example, indigenous knowledge is often connected to specific expectations about how policymaking should work, such as non-hierarchical politics and non-recognition of systems of patriarchy, gender binaries and age discrimination (Whyte 2018). Indeed, research on the socio-politics of knowledge has developed various concepts to examine how knowledge derives meaning and authority through its connection to hidden politics, including "discourse coalitions" – unconsciously shared discourses of environmental phenomena by actors cognitively advocating different political outcomes (Hajer 1997) – and "civic epistemologies" –

culturally specific ways of assessing evidence that sustain the authority of particular roles and knowledges[4] (Jasanoff 2005; Miller 2008; Haines 2019). Such concepts indicate the inseparability of knowledge from the political contexts that give it meaning, and why it might not simply be extracted and translated into different domains with easily anticipated effects (Whyte 2018).

This inseparability has led co-productionist scholars to view climate knowledge as narratives – "subtle mechanism[s] of maintaining discursive order" (Hajer 1995: 56; Forsyth 2019). Narratives "play a key role in positioning subjects and structures" (Hajer 1995: 56) and as such are important forms of agency for different actors and different ways of knowing. Moreover these effects are largely non-cognitive, as "people do not recognize them as moments of positioning" (Hajer 1997: 56). At the same time, narratives present opportunities for socio-political change when new storylines emerge that re-order understandings of relations between citizens, state and environment (Hajer 1997: 56). Some existing work has viewed narratives as unchallengeable connections between dominant power structures and knowledge, yet social studies of science have regarded narratives more as a reflection of fluid interrelations between representations and contemporary politics, which illuminates these opportunities for political change. Viewed as such, public consultation has the potential to alter narratives and their constitutive potential if it can understand and intervene in these interactions.

The tensions discussed here suggest that the way co-production is conceptualized and implemented affects how the democratization of environmental policy is sought and what outcomes are achieved. At the same time, there has been

[4] Civic epistemologies have been discussed as the established and institutionalized civic procedures of highly developed democracies, and less in more fragile political contexts where state authority depends upon tacit alliances with powerful groups, where civic epistemologies represent not just institutionalized practices but the political interactions between diverse interests.

little analysis comparing the different effects of these two approaches in practice in adaptation to climate change, and there is a need for comparative insights on the extent to which politics shapes the production of subjects and narratives, and with what effects for adaptive governance. Reflecting these concerns this paper seeks to draw lessons for the democratization of climate policy through co-production by addressing three questions that place these two approaches to co-production side by side in two locations.

- First, to what extent are the identities of local actors essential and visible, or dynamic and responding to contemporary politics?
- Second, to what extent are local visions of risk autonomous, or reflecting political concerns?
- And third, what lessons can be drawn for democratizing adaptation to climate change by comparing consultative and analytic co-production?

The remainder of this paper examines these questions in the context of storm governance in Mexico and India.

3. Studying storm governance and co-production in Mexico and India

3.1 Storms and co-production

Storm governance is an arena of maladaptation where the effects of analytic and consultative co-production are under-explored. Globally, the biggest storms cost an estimated 94.5 billion US dollars and resulted in 527 deaths in 2021 (Kramer and Ware 2021), and the Intergovernmental Panel on Climate Change (IPCC) projects that tropical cyclone frequency and intensity will increase in coming years (IPCC 2022). Socio-economically marginalized people are increasingly regarded as disproportionately exposed to harm from storms because of their pre-existing

precariousness, such as lack of alternative livelihoods, food security and under recognition of their needs by politicians (Rakatobe et al 2016; Hilhorst and Bankoff 2004).

Despite this, coastal adaptation has been associated with two forms of maladaptation – those that redistribute vulnerability and those that create new forms of exposure (Eriksen et al 2021; Ferdous et al 2020; Donner and Webber 2014). These outcomes have been linked to a focus on physical defence – either through engineered structures such as groynes, seawalls and shelters or ecological protection such as mangrove plantations – and its lack of engagement with social aspects of vulnerability (IPCC 2019). For example, cyclone strategies on the east coast of India that have involved moving coastal fishing communities into more physically robust concrete homes inland have exacerbated their socio-economic exposure by moving them farther away from access to marine livelihoods (Bavinck et al 2014). Similarly, fishing bans during stormy weather have kept fishers physically safe but worsened their economic precarity by preventing them from earning a living when not combined with an alternative income stream.

Consultative co-production has been proposed as a way to connect scientific expertise to local needs and "recognize how infrastructural and technical interventions reshape power relations" (Eriksen et al 2021: 5; Dhakal and Mahmood 2014; Tubridy et al 2022; Chakraborty et al 2021). For example, the Global Facility for Disaster Reduction and Recovery (GFDRR) argues that "by engaging the community and facilitating citizens to be leaders for the production, dissemination, and review of risk information, an inclusive process can create opportunities for ownership in DRM activities" (GFDRR 2022). At the same time, the effects of consultative co-production in storm governance are not clear. For example, Bavinck et al (2014) show how a

participatory approach to post-tsunami relocation of fishers inland in Tamil Nadu, which involved the co-design of homes and allocation procedures, has still resulted in many fishers returning to their previous coastal homes to be closer to their fishing profession. This suggests a need for greater attention to exactly what knowledge is being collaborated upon and what successful collaborative outcomes looks like.

Moreover, debates around storm adaptation raise questions as to the role of local people in consultative co-production. Some scholars have viewed improvements to infrastructure as maladaptive because of how they encourage people to stay in areas that are high risk (Magnan et al 2016) while others have pointed to problematic "belief systems" of local people, arguing that "the roots of maladaptation can thus be cognitive just as much as they can be rooted in financial constraints or flawed engineering" (Heltberg and Bonch-Osmolovskiy 2011: 5). But if this is the case then there is a need for deeper reflection on what knowledges local people are expected to voice in consultation, and what makes some belief systems more correct than others.

3.2 Selecting sites

This research sought locations that experience frequent storms, together with vulnerable communities and authorities articulating contrasting visions of storm risk – that is, the cognitive and visible criteria for consultation. The towns of San Felipe in Yucatán, Mexico and Poonthura in Kerala, India both frequently experience high magnitude storms, including hurricanes and cyclones. They also have vulnerable fishing communities at increasing risk from storms, and state bodies charged with producing expertise for storm governance – including the Civil Protection and Port Captain in San Felipe, and the Kerala State Disaster Management Authority (KSDMA),

Institute for Land and Disaster Management (ILDM) and Cyclone Warning Centre (CWC) in Kerala.

Third, in both cases these actors express visibly the same contrasting visions of risk. In both locations, governments have focused on moving fishers out of physical harm's way by improving the robustness of homes and infrastructure, building shelters, upgrading meteorological systems, and broadcasting fishing bans. Meanwhile fishers have complained that they are at greater risk from diverse and complex socio-economic effects such as a reduced income from fishing bans, disruption of fish migratory patterns, and a reduced ability to read weather patterns. Moreover, fishers in both sites have their own weather monitoring systems that involved traditional methods of examining clouds and tidal patterns combined with communication via GPS, SMS and telephone. Consequently it was decided that these were reasonable sites to conduct this analysis because they share similar storm impacts, actors, and cognitive articulations of risk.

It was also important that these locations differed in ways that would indicate the extent to which contemporary politics shapes actor identities and knowledges through analytic coproduction. Poonthura and San Felipe were illustrative in this regard as their fishers experience different socio-political orders. On one hand, Kerala is often regarded as a political and socio-economic success story. It is India's highest ranking state in the Human Development (HDI) and Multi-dimensional Poverty (MPI) Indexes with almost universal healthcare and education (Heller 2005) reflecting a "politics of the common good" (Singh 2010: 538). Yet Kerala's fishers have remained excluded from these achievements, remaining socio-economically marginalized, living in segregated, semi-permanent crowded coastal communities with much lower developmental indicators (Kurien 1995). At the same time, Kerala's fishers have a

proud history of political activism (including recent demonstrations over trawling and the removal of the women fish-vendors bus) spearheaded by unions and organizations such as the National Fishworkers Forum (NFF). As such, Kerala's fisher activists reflect the state's culture of "active involvement in democratic politics" (Drèze and Sen 2013: 86) having clear expectations about what government should deliver despite their considerable marginalization.

In San Felipe, the political context is different. Incomes have decreased by 37% in Mexico between 2008 and 2020 (World Bank; CEIC 2020), and corruption is perceived to be rampant (Transparency International 2021), suggesting much lower expectations of what the government can and will provide to its citizens. The relationship between fishing communities and wider society is also different in San Felipe. While, like Kerala San Felipe's fishers have lower levels of educational attainment, sanitation and living standards than the rest of Yucatán (Salas et al 2010) they are not marginalized from the rest of society as in Kerala. Despite economic precarity, the town has historically been a close-knit fishing community characterized by strong social ties across groups working in tourism, agriculture, shop-ownership and fishing. These strong social ties extend beyond San Felipe, increasing their sense of social inclusion within the state of Yucatán, with important implications for how risk is experienced, since many fishers rely upon connections to friends and family inland for refuge from storms.

3.3 Methods for studying co-production in practice

This research seeks to examine tensions between consultative and analytic co-production by examining processes of analytic co-production in detail, by studying the extent to which non-cognitive politics influences the identities and knowledges of local

actors consulting about storm expertise. To do so it examines fisher narratives of storm risk because such storylines indicate the non-cognitive interaction of subjects, knowledge and politics. Reflecting this approach, an important goal was to capture how politics and risk interacts in fisher articulations of vulnerability. To this end, surveys allowed for comparison of fisher responses between San Felipe and Poonthura, while longer, semi-structured interviews generated space for connections to broader and unanticipated political concerns to be explored. Questions sought to reflect the interrelatedness of vulnerability and political order by being ambiguous and multivalent such as, “how do storms affect you?” or by focusing on their particular experiences of risk such as, “what makes you feel vulnerable to storms?” The fieldwork was undertaken in 2018 (San Felipe) and 2019 (Poonthura). A Malayalam translator assisted in Poonthura while interviews in San Felipe were done in Spanish by the author. Working across languages presented challenges interpreting meanings, such as of “climate change” which variably referred to changes in seasonal weather patterns and a global political-ecological phenomenon characterized by social justice controversies. Interviews were recorded and transcribed to capture exactly how fishers articulated their responses. Discourse analysis examined how articulations of risk and subjectivity were connected to the fishers’ particular socio-political concerns. This entailed focusing on the following narrative themes:

- ***Risk knowledge:***
    - *Allocation of responsibility for harm:* Refers to who (if anyone) is expected to prevent harm from weather events and how. This could be NGOs, government bodies, themselves, or “nature”. This theme

indicates ways in which visions of risk are shaped by fisher expectations of the political order.

- *Causation of harm*: Refers to the origin of harm. This could be bio-physical changes sea and weather patterns, lack of search and rescue, lack of livelihood diversity. The origin of harm and responsibility for it could be different or the same, dependent on their relation to the political order.
- *Solution*: Identifies perceived solutions to risks, such as livelihoods support or sea walls, which will be shaped by how fishers perceive their situation within contemporary politics.

- ***Fisher subjectivities:*** The role fishers expect themselves to play in society, reflecting local political norms and values
- ***Government subjectivities:*** The role fishers expect the government to play in political society, indicating how fishers view themselves in relation to the political order in which they are embedded.

Table 2: Information sources

Location	**Collection of narrative material**
Poonthura	• *Surveys:* 35 fishers surveyed, 28 men (12 aged 20-35; 11 aged 36-50; 5 aged above 50) and 7 women (4 aged 20-15; 3 aged 36-50). • *Semi-structured interviews*: 9 fishers interviewed, 3 women and 6 men, from organizations such as South Indian Federation of Fishermen Societies (SIFFS), NFF, and Association of Women Fish Vendors. • *Interview site:* coastline of Poonthura and Kerala: on the beach, on the concrete shorefront, and in fishers' homes. • *Date*: August 2018, May-June 2019 and January-February 2020.
San Felipe	• *Surveys*: 27 fishers surveyed, 24 men (13 aged 20-35; 7 aged 36-50; 4 aged over 50) and 3 women (aged 20-35). • *Semi-structured interviews*: 6 fishers interviewed, 1 woman and 5 men, from different cooperatives and permit-holders. • *Interview site:* San Felipe Coastline and cooperative offices.

	• *Date*: October-November 2018.

Source: author

4. Narratives of storm risk in San Felipe and Poonthura

This section presents information on fisher identities and visions of risk in San Felipe and Poonthura. Sections 5.1 and 5.2 discuss the extent to which these identities are wholly visible or dynamically responding to contemporary politics, and the extent to which these visions are autonomous or reflect political concerns. Section 5.3 examines comparative lessons for democratizing adaptation.

4.1 Four risk narratives

Fishers in San Felipe and Poonthura articulated four visions of risk: risk as a physical external "force of nature", as ecological degradation, as socio-economic vulnerability, and as social vulnerability. For fishers in the two towns these knowledges expressed how they felt vulnerable to harm from an increasing incidence of storms, but were associated with different notions of blame, responsibility and causality and different fisher and state identities in each.

Table 1: Fisher narratives of storm risk in San Felipe

Vision of risk	**Risk knowledge**			**Fisher subjectivities**	**Government subjectivities**
	Allocation of responsibility	**Causation of harm**	**Solution**		
1. A physical force of nature	Nature; no person or government.	Nature's physical impacts such as wind and rain.	Evacuation; cooperation with inland communities	Self-sufficiency in protection of assets. Unique understanding of nature.	Absent except for providing evacuation and warnings.
2. Ecological destruction	Citizens for un-ecological behaviour (futility of blaming government corruption).	The state of society; human lack of responsibility and care to nature.	Look after yourself, your family and nature.	Guardians of nature. Community leaders.	Not enforcing laws; concerned with political connections and commercial gain.

3. Economic vulnerability	Fishers.	Physical impacts of nature.	Livelihood diversification through tourism (e.g. birdwatching, mangrove tours), ranching and store-ownership; migration.	Economic self-sufficiency. Part of socio-economic networks based on family and friendship.	Absent, non-interventionist. Concerned with own economic gain. Corrupt, immoral.
4. Social vulnerability	No one. It's just life, people want to earn more and there's no law enforcement.	Disintegration of social cohesion; migration; lack of law enforcement.	Social conflicts managed by coops and community leaders.	Free and separate from government institutions. Morally authentic and uncorrupt.	Absent, not interventionist.

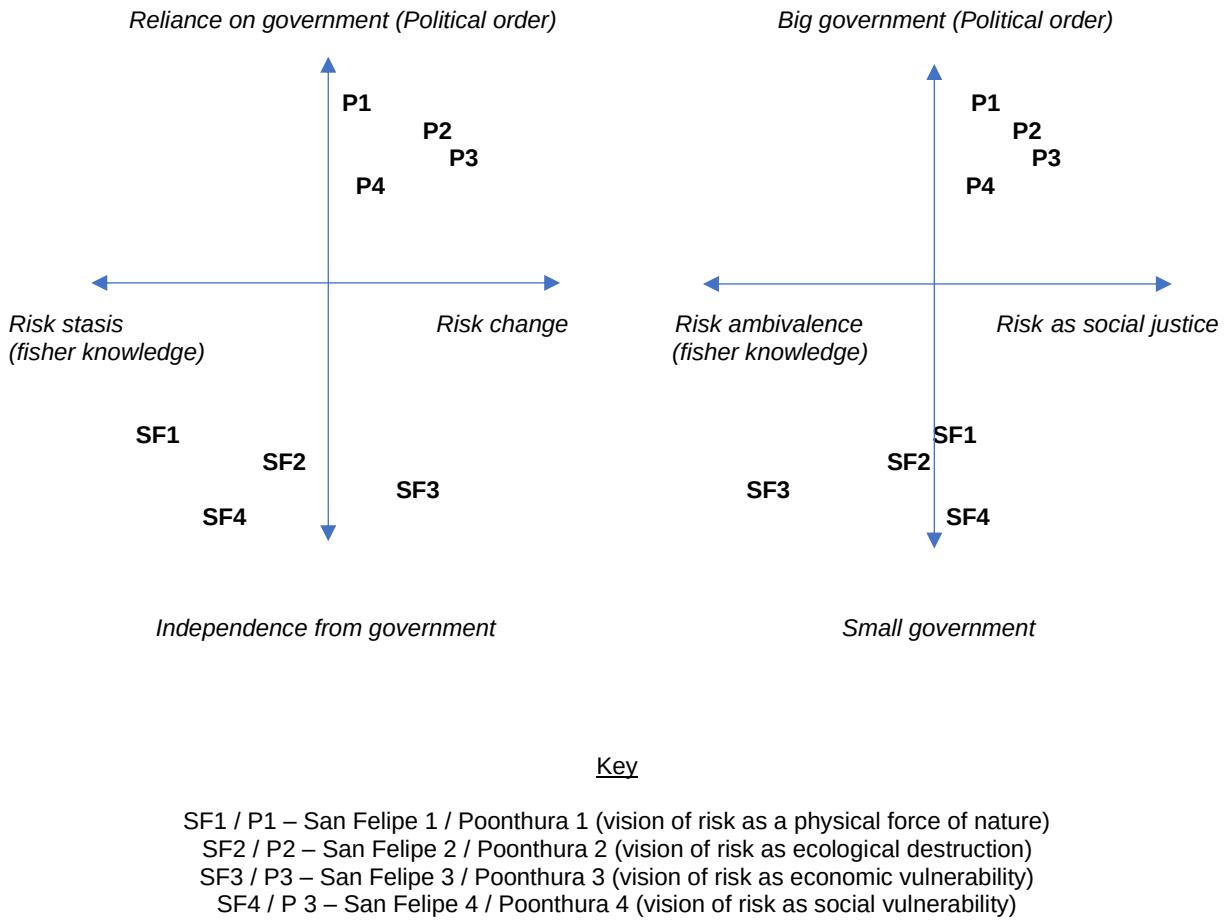
Source: Fieldwork

Table 2: Fisher narratives of storm risk in Poonthura

Vision of risk	**Risk knowledge**			**Fisher subjectivities**	**Government subjectivities**
	Allocation of responsibility	**Causation of harm**	**Solution**		
1. A physical force of nature	Government to give more accurate warnings.	Insufficient, and inaccurate warnings; government protecting reputation rather than fisher lives.	Fishers to fight for "our sea".	Protestors, activists. At the mercy of Mother Nature.	Responsible for the protection of all citizens, including fishers.
2. Ecological destruction	Government to enforce laws.	Big boats, rich countries, greedy corporations.	Law enforcement; environmental policies.	A representative of Mother Nature. Uniquely connected to nature.	Responsible for protection of Indian ecology.
3. Economic vulnerability	Government to provide economic support.	Lack of government support.	Government to give pension, subsidy and compensation for no fishing days.	Victim of political-economic injustice. Protestors. Citizens of Keralan society.	Responsible for economic equality within Kerala.
4. Social vulnerability	Caste system; society that marginalizes them; structural inequalities and injustices.	Access to drugs and alcohol.	Education; alternative livelihoods provided by state like shop ownership or search and rescue training.	Socially excluded (unfairly). Victims of injustice. Activists. Citizens of Keralan society. Protestors	Responsible for ensuring social equality and universal welfare in Kerala.

Source: Fieldwork

Figure 3. How political orders intersect with desire for change and social justice



Source: Fieldwork

4.2 San Felipe

4.2.1 Fisher subjectivities

In San Felipe, fishers were characterized by pride in their independence from the government. When discussing their vulnerability to nature's physical forces, this manifested as a sense of self-sufficiency in their capacity to protect their assets, as well as a unique capacity to understand nature and know the limits to which it can be controlled. In discussions of ecological vulnerability, fishers saw their interests as aligned with safeguarding nature, as well as seeing themselves as community leaders

for ecological protection, such as the protection of mangrove forests bordering the town. In the context of economic vulnerability, this independence manifested as a strong sense of economic self-sufficiency and community-orientation. Many regarded themselves as part of much wider social networks based on family, friendship and economic ties, stretching beyond the geographical boundaries of San Felipe. Socially, San Felipe's fishers regarded themselves separate from government political and legal institutions, and relatively free and uncontrolled by these structures. Fishers also saw themselves as distinctly honest and straightforward, living morally simple and authentic lives centred on fishing, and caring for friends and family. Indeed, they identified as the opposite of the government's corrupt and immoral concern with its own advancement.

4.2.2 Government subjectivities

In response to bio-physical risks, the government was expected to be largely absent except to deliver warnings and evacuation – short term response strategies to immediate physical impacts rather than long-term ex-ante strategies. Even when fishers received what they saw as inaccurate warnings or limited support for evacuation, there was no expectation that the government would provide anything different. As one fisher remarked, "you know other countries may receive more accurate information, but we do not expect so much here, we have learnt our own way of managing" while another commented, "what else can they do? It's a natural phenomenon".

The government was not expected to enforce environmental laws for protecting marine ecology. Fishers believed government actors were bribed to turn a blind eye to sea cucumber fishing and development in protected areas. As such, ecological

vulnerabilities were seen simply as “how things are”. As one fisher commented, laughing with his hands in the air, “the government will not do anything, it is how it is”.

Fishers did not expect economic assistance from the government. Many commented that there was no point in even asking for this since the government would only give it to those with whom it has party-political connections. As one fisher said, “for those who are PRI [Institutional Revolutionary Party], maybe, but for those who are not we don’t bother [asking]”. Indeed, many fishers even regarded government shelters as unnecessary. As one fisher commented, “if the government wants to help, then that’s fine. Otherwise people save and they are OK”.

When asked whether the government should help with social vulnerabilities, fishers responded with comments such as, “it’s just life” and “the government doesn’t know…why doesn’t it know? Well it knows, but it doesn’t do anything”. Once again the government was not expected to intervene on issues that did not potentially deliver financial benefit.

4.2.3 Risk knowledge

In San Felipe fishers frequently articulated storm risk in terms of the bio-physical threats of “nature”. Comments such as “it’s a natural disaster”, “it’s an education from childhood that these natural phenomena will affect us” and the danger of the “wind from the north” expressed a sense of vulnerability nature’s bio-physical impacts. No one – no person or government was regarded as responsible for the harm caused by wind, rain and waves, rather causation was attributed to their bio-physical impacts. The solution to these risks is seen as evacuation and cooperation with inland communities.

San Felipe's fishers also discussed vulnerability to storms as a function of ecological degradation. Key concerns were the cutting down of mangrove forests, plastics pollution in the sea and overfishing. Mangroves were regarded as providing a natural barrier to strong winds, as well as a place to store boats during storms, while plastics and overfishing were seen as reducing the health and abundance of marine life, thereby incentivising fishing during bad weather. Fishers allocated responsibility for this to a general societal malaise that manifested as lack of responsibility and care for the environment. Despite regular flouting of ecological laws, the government was not blamed for their lack of enforcement. Rather, the way to address ecological vulnerability was for fishers to look after themselves, their friends and family, and the environment, often through self-organized community groups. Accordingly, many expressed the need for their fellow citizens to "play a bigger part in cleaning up the water and shoreline".

The most regular and ardent articulation of storm risk was its impact on livelihoods. San Felipe's fishers listed various dimensions of economic vulnerability, such as lack of storage for boats during storms, damage to equipment, fluctuating fish prices, decreased catch, and fewer customers during hurricane season. In general, fishers were more concerned about the impacts of storms on the value of their assets and their earning capacity than on their lives. Significantly, San Felipe's fishers regarded the physical impacts of storms to be the causes of this economic vulnerability, rather than pre-existing factors such as socio-economic vulnerabilities or lack of government support. Livelihood diversification strategies such as keeping farms inland, running grocery stores or acting as tourist guides were all regarded as normal and necessary to address economic vulnerability, and not something that the government was expected to help with. Indeed fishers also took responsibility for

safeguarding their own assets, through finding houses for their boats, putting nets on their rooves to stop them blowing away, hiding furniture and cutting down trees near the house.

Fishers also expressed storm risk in terms of social friction and exclusion. In San Felipe, many who identified as long-standing residents regarded the immigration of people from neighbouring states such as Tabasco and Veracruz to work on the increasing number of 'permit-holders' (contractors who buy boats and permits and employ mostly migrant fishers) as a cause of social disconnection that increases risks in storm season. Increasing friction between permit-holders and cooperatives – who have historically dominated in San Felipe – was blamed for generating social tensions and conflicts and greater competition for fish. Interviewees from permit- holders and cooperatives each blamed the other for overfishing and illegal fishing practices that lead to reduced incomes and more hazardous fishing practices, particularly during hurricane season. Yet "no-one" was to blame for these vulnerabilities, rather they were seen to be part of life: "people want to earn, and this is the way it is". Here, general disintegration of social cohesion and lack of law enforcement was accepted as an unchangeable norm; there was no point in blaming the government because it was not expected to do anything. Rather, the solution was for fisher to address social conflict themselves, through interventions and mediation by cooperatives and community leaders.

4.3 Poonthura

4.3.1 Fisher identities

In Poonthura fishers often identified as activists deserving of greater government support. An important part of their argument was their unique relationship

with ‘nature’. Through their work fishers frequently positioned themselves as capable of “reading nature” and also “her” unique representative within society, and hence with a crucial role in safeguarding ecological life. To make this identity more visible they often articulated a sense of shared victimhood with the government and Indian citizens at the hands of international greed and injustice.

Economically, Poonthura’s fishers saw themselves as victims of structural political-economic injustice and activist-protesters, as well as legitimate citizens of Keralan society who were unfairly marginalized. A representative from NFF commented that, “all marginalized people must work together to get their voices heard. We must keep fighting”, while another said that, “money does not lead to opportunities, only voice does”. Fishers saw their role as “agitating” and “protesting” to make their needs heard to the government. They expected the government to listen and respond.

Socially, Poonthura’s fishers regarded themselves as unfairly excluded from Keralan society due to the caste system, and as such victims of social injustice. Again, they saw their role as protesting this injustice to bring about social change. As an NFF representative explained, “because of the class system in our society, the upper class people think that we are lower class… but we need to live like others. Our community should come forward like others” [P8]. That is, Kerala’s fishers expected to change their social standing through hard work and political activism.

4.3.2 Government identities

In general, Poonthura’s fishers saw the government as responsible for addressing the risks they faced. Regarding bio-physical vulnerability, fishers believed the government’s warnings were unsatisfactory and could be improved if they listened to fisher needs. One fisher commented that, “the warnings are more about protecting

government reputation than fisher lives. Fishers are not considered important by the government, but we will fight". Fishers here clearly expected the government to listen to their needs if they protested.

The government was also seen as responsible for conserving India's ecology and ensuring environmental sustainability. Poonthura's fishers expected the government to "protect India" from polluting international corporations and nations through law enforcement in national and international arenas. Fishers regarded the government as acting on behalf of its citizens – fishers included – to challenge the "highly polluting rich countries" that were seen as responsible for the increase in storms and coastal erosion.

Poonthura's fishers also expected the government to economically support fishers facing increasing storms. A representative from SIFFS argued that, "in Norway and the US there are subsidies for agriculture and fishing. Here there is no subsidy". Fishers also expected the government to intervene to help them become less socially marginalized from the rest of Keralan society by extending social welfare policies to their communities.

4.3.2 Risk knowledge

In Poonthura, "Mother Sea" and "Mother Nature" were frequently positioned as responsible for the physical impacts of nature. Indeed, among older fishers in Poonthura, storms were regarded as an act of punishment from Mother Sea and her "wrath". Yet, unlike San Felipe, the bio-physicality of harm was not seen as its cause, rather this was blamed on inadequate warnings – the government's responsibility. Many felt frustrated by the frequency of storm warnings that prevented them from going fishing because they regarded them as faulty or mistrusted the government's intentions.

Examples of ecological vulnerability included an increasing risk of storms, coastal erosion, plastics pollution and decreasing catch due to overfishing from non-traditional fishing practices such as trawling. Responsibility for this was allocated to big trawler companies, “greedy corporations”, and “rich country emissions”, but ultimately, the government for holding these actors accountable through established legal and political institutions.

As in San Felipe, economic vulnerability was the most frequently articulated risk. Concerns included fishing bans, tax increases, fuel price increases and exploitation by middle-men. Yet in Poonthura the state was seen as responsible for addressing this exposure through compensation for no-fishing days, fuel subsidies, and state pensions, as well as training in alternative livelihoods such as search and rescue, and loans to set up corner shops.

Poonthura’s fishers expressed multiple forms of social vulnerability. Various interviewees and survey-respondents said that Keralans view fisher-folk as “dirty”, “uneducated” and “lower class”, while an NFF representative told me that, “caste issues are real here…we are like Adivasi”. Many representatives of fisher organizations such as NFF and SIFFS blamed the modern culture of Keralan society for corrupting fisher society, as one SIFFS representative explained, “fifty years ago we had traditional customs, didn’t use drugs and alcohol. Now there is bad culture, they accept the bad things of civilized people”. Fishers believe this social marginalization is a form of vulnerability in times of storms because it stops them from receiving assistance that would be given to other citizens. An NFF representative explained that, “fishers here are not respected. In Japan, they have advanced technology to protect fisher people, India does not”. These concerns were particularly acute in discussions of the rescue effort after Ockhi – a cyclone resulting in the death

of more than 200 traditional fishers in 2017 – which many interviewees regarded as insufficient because the authorities would not take fishers with them on the search missions. Many Poonthura residents frustratedly discussed how their expert knowledge of the sea could have helped find friends and family members, but they were excluded from the mission because they are not respected.

5. Discussion: Co-production in storm governance

5.1 The dynamic constitution of actor categories

What do these identities tell us? It is clear that fisher identities are dynamically constituted with the political contexts in which they live. In San Felipe, the government plays a minor role in the lives of its citizens, and here fishers expect government institutions to be largely absent: they do not expect ecological laws to be enforced such as mangrove cutting or illegal fishing of sea cucumber, nor economic support when they cannot go fishing because of storms, nor for the government to intervene in social issues, such as drunken behaviour or conflicts between cooperatives and permit-holders. When it comes to storms, the government is only expected to give weather warnings, and assist with evacuations. Consequently fishers pride themselves on their self-sufficiency and independence. Their pride in forging strong community networks and familiar links is co-produced with their rejection of the government's immorality and corruption. Their community-based adaptive strategies, independent subjectivities and untrusted political order are dynamically co-constituted.

Conversely Poonthura's fishers expected the government to enforce environmental laws, provide economic support through pensions, subsidies and alternative livelihoods, and address social injustices. These more extensive expectations reflect the Keralan democratic contract, in which state authority is

legitimized through its delivery of universal social and economic welfare, from which Poonthura's fishers saw themselves as unfairly excluded. At the same time their activism reflects the Keralan political contract in which its citizens are expected to actively participate in politics to hold the government to account. This activism is fundamental to their identity, as one NFF member commented, we are "always fighting fighting fighting". Their subjectivities, conceptions of vulnerability and expectations of the political order are all interactionally co-produced.

Fisher identities in San Felipe and Poonthura are hence contrasting, reflecting contrasting political orders. In San Felipe fishers took pride in their independence whereas in Poonthura they took pride in enacting the citizen's duty of protesting and demanding social justice. In San Felipe fishers held a strong belief in their agency to generate societal cohesion, whereas in Poonthura fishers saw themselves as victims to structural social marginalization through the caste system. Fishers in San Felipe protected nature because they believed no one else would, while in Poonthura fishers aligned their interests with Mother Nature to advocate on behalf of their own unique citizenship to gain better political visibility. As such, these identities should be considered predominantly as subjectivities – non-cognitively and dynamically constituted in response to the political contexts in which they are embedded – and not essential or wholly visible.

The effects of contemporary politics on the category of 'fisher' in Poonthura and San Felipe warn against inclusion as a straightforward solution to empowering local voices. Consultative co-production aims to empower certain actors by including them in participatory spaces, yet instead often reinforces existing political structures and hierarchies. This analysis shows how this might happen when political structures travel with local actors included in consultative interactions through subjectivities, thereby

influencing these interactions. This suggests that understanding the possible outcomes of consultation requires understanding what the subjectivities of local actors such as fishers are, and how they emerge and change.

5.2 The political concerns driving risk knowledge

What can we learn from fisher risk knowledges? While ostensibly articulating the same four visions of risk, fisher narratives of physical, ecological, economic and social vulnerability actually responded to different political concerns. First, In San Felipe, the cause of and responsibility for harm were both located in the bio-physicality of impacts, reflecting limited expectations of what the government could be held accountable for. Yet in Poonthura, while bio-physical impacts *caused* harm, the government was seen as responsible, reflecting citizen expectations of a state legitimated on its welfarist policies. In San Felipe risk is nature's physical impacts, while in Poonthura risk is inadequate protection from those impacts.

A similar difference is evident on the theme of ecological degradation. In San Felipe, environmental risk means working independently with communities without government interference, reflecting fisher expectations of a corrupt, unreliable government and their need to be self-sufficient. Whereas in Poonthura cyclone risk means working *with* government institutions, reflecting a political context in which the state is trusted to deliver assistance, and citizens are expected to ask for it.

The diverging political contexts of San Felipe and Poonthura also produced different meanings of economic vulnerability. Whereas in San Felipe, fishers associated economic vulnerability with nature's physical impacts, in Poonthura it meant political injustice. In San Felipe economic vulnerability meant building their own

alternative businesses, whereas in Poonthura it meant protesting the government to provide subsidies and pensions.

Finally, social vulnerability also meant different things for San Felipe and Poonthura's fishers. In San Felipe social vulnerability meant the inability to maintain social networks and connections, whereas for Poonthura's fishers it meant the caste system positioning them as socially and politically inferior. These contrasting risk narratives reflect their diverse political environments. While in San Felipe the erosion of community togetherness was seen as something fishers needed to fix, the exclusion of Poonthura's fishers from Keralan society was regarded as a historic structural injustice that only the government could change.

In San Felipe then, risk is a product of how fishers expect the state to be largely absent from their lives, while in Poonthura risk reflects an expectation that the government should attend to fisher needs. This shows how these four ostensibly identical visions of risk are actually very different narratives of vulnerability, responding to different political contexts, and hence should not be understood as autonomous, decontextualizable pieces of information. Rather, for consultation to generate expertise that is more relevant and useful to the needs of local people it is necessary to understand how contemporary politics shapes what risk actually means to local people.

5.3 Comparative insights for adaptation

Section 5.2 discussed various noncognitive meanings and effects that would be missed by an extractivist approach to knowledge or by focusing on visible identities alone. Implications for adaptation strategies lie in how meanings and subjectivities shape who is targeted by formal expert advice, while simultaneously hiding the

diversity of concerns about storms that are not explicitly mentioned. Figure 3 indicates some ways in which this might happen. The two diagrams show how the intersection of political orders and risk knowledges suggest how policy might bring about long-term changes to the meaning and course of sustainable development. On the left we can see how political order is associated with change in exposure to risk. In Poonthura, fisher expectations of the welfarist state are associated with an expectation that their vulnerability can change in the future. Conversely, in San Felipe, fisher subjectivities of self-reliance generate a sense that little will change, except in their economic vulnerability, if they are able to find jobs in sectors other than fishing such as tourism. On the right we can see how Kerala's "big" government produces an expectation of social justice, while San Felipe's "small" government leads them to feel ambivalent about the fairness of their economic, ecological and social vulnerabilities: they not discuss or seek a thing called justice, nor do they expect it. This suggests that adaptation policies might be framed within wider narratives of changing the political structures by which justice and injustice are distributed in Poonthura, but that this would have little relevance or resonance in San Felipe.

At the same time these risk narratives indicate different roles for state institutions and citizen relations. For example, the political meanings of economic vulnerability and social vulnerability in San Felipe suggest that policies regarded as citizen-owned and mediated through informal social connections will be more trusted and effective than those delivered via official procedures of law enforcement or institutionalized political frameworks, where fishers pride themselves in their independence from the state. Conversely, institutionalized approaches to risk governance such as training in alternative livelihoods and search and rescue would

likely be successful in Poonthura, indicating social, cultural and political acceptance in the state's democratic community.

6. Conclusion: Re-interpreting co-production to democratize adaptation?

How can knowledge co-production democratize climate expertise? An increasing number of scholars now "believe in advancing co-production as an important approach to increasing the impact of science" (Lemos et al 2018: 722). A growing arena of application is in the design of adaptative strategies. For example, the IPCC Working Group II 6th Assessment report suggests that "co-productive and participatory decision-making processes and knowledge systems…often leads to adaptation action that meets societal needs" (New et al., 2022: 4). Yet research has suggested a need for greater attention to how collaborative methodologies are influenced by non-cognitive politics in order to meet these expectations. This paper has sought to address this dilemma by drawing upon the framework of analytic co-production and comparatively studying how the actors, knowledges and politics of consultation are co-constituted in two sites in Mexico and India. This comparative approach has revealed various insights for debates about democratizing climate expertise through collaboration.

First, collaborating with local people to produce climate expertise has been regarded as a way of empowering local people and knowledges. Yet comparing San Felipe and Poonthura shows that it is not the inclusion of fishers that increases their agency, but how their subjectivities are connected to wider political agendas that make them visible in particular ways. Moreover, it is not detached climate knowledges that generate new forms of expertise but the ways in which these knowledges reflect and reify contemporary political concerns that give them meaning, authority and relevance.

As such, the democratization of expertise is not to be found in more transparent processes of integrating actors and knowledges, but understanding how non-cognitive politics influences what they say, how they say it, and how (or whether) it is heard. Comparing fisher narratives in San Felipe and Poonthura highlights how diverse politics shapes how fishers make themselves and their vulnerabilities visible. Further analysis could examine how state narratives of subjectivities and political order see *fishers* and their risk knowledges.

Second, this research has shown that existing discussions of maladaptation do not sufficiently engage with what local people value as adaptive outcomes. Existing work has argued that adaptation expertise often fails because it is not done in a sufficiently participatory way. Yet this work has shown that existing approaches to consultation are unable to fully engage with what adaptation means to local people, because of a focus on visible identities and cognitive knowledges. Analytic co-production can assist here by showing more deeply what vulnerable subjectivities are and how local people experience exposure to climate change. Such considerations are important because they shape what maladaptation actually means to local vulnerable people, with implications for how adaptation is sought. For example, maladaptation that considers fishers as irrational for not following local storm warnings might lead to consultation on how to make warnings more loud and prolific; whereas maladaptation that regarded their need to earn an income even at risk of physical harm as rational might lead to consultation on how to supplement their income on no-fishing days.

Third, this work shows the contested nature of “democratic” expertise. Existing collaborative work has suggested transparent and structured procedures of bringing diverse actors together can generate democratic expertise. Yet comparing co-

production in San Felipe and Poonthura shows democratic storm knowledge to be different phenomena – consisting of connecting fishers to the state in Poonthura and connecting fishers to social networks independent of the government in San Felipe. As such it is not transparent integration that democratizes risk knowledge, but understanding how local people, politics and knowledges dynamically co-create one another. Indeed, this adds to existing research on analytic and collaborative co-production, which has largely been theoretical, distinguishing between the alleged normative aspirations of consultation to democratize and the descriptive purpose of analysis. Yet this work suggests that analytic co-production should be considered deeply democratizing – and indeed a crucially democratizing component of consultation – because rather than taking the norm of democratization for granted, it asks what it means, how this meaning is produced, and how it should be achieved. As such, democratizing expertise requires reinterpreting co-production from being merely about integration (and with analytic co-production as a separate project) to incorporating how collaborative methodologies, local politics and knowledeges are co-created.

Lastly, we might also consider how practitioners and scholars shape the democratization of co-production. Analysts are embedded within contemporary political norms and values that shape our work in cognitive and non-cognitive ways like the actors we examine. Scholars have long debated the extent to which academia is a place of cognitive political activism and “the complex social relations that exist between researcher and researched” (Kitchin and Hubbard 1999), yet the influence of non-cognitive politics on academic work remains under-examined and undertheorized. One approach has been to encourage more active reflection on the positionality of the researcher at the outset of a piece of research, and state the relevant positionalities

of the references cited (Liboiron 2021) yet this is not yet a common practice. Further research on how non-cognitive politics shapes the co-production of knowledge and socio-political orders within academic research might encourage the uptake of these and other such practices.

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Fixing Subjects Fixing Outcomes: Civic epistemologies and Epistemic Agency in Participatory Governance of Climate Risk

Abstract

Participatory forms of policymaking have often been criticized for insufficiently theorizing the coproduction of publics and matters of concern. This paper seeks to investigate this relationship further by analyzing how the concept of civic epistemologies (CEs) can provide insights for understanding how political contexts shape both publics and contestable debates. Presenting fieldwork on cyclone governance in Odisha, India, based on analysis of interviews with vulnerable fishing communities and state actors, the article shows how CEs influence the interdependent formation of vulnerable fisher and state subjectivities on one hand with representations of risk located in external bio-physical atmospheric gases on the other, thereby sustaining reductive roles and futures. At the same time, the paper develops the concept of CEs by examining them as performative acts carried out by marginalized communities and state actors at the sub-national level of a non-industrialized country, thereby indicating sites at which epistemic agency can be increased and governed. Participatory knowledge production needs to understand how it is affected by CEs if it is to generate effective expertise for transformative futures in the face of increasing climatic risks.

Introduction

The framework of participation is frequently proposed as way of delivering expertise that is inclusive, relevant and emancipatory in the face of urgent climatic changes (Norstrom et al. 2020; Meadow et al. 2015; Reyers et al. 2015; Mauser et al. 2013; Chambers 1997, 2007). And yet significant challenges persist. Two central concerns are that participatory interventions often fail to empower marginalized actors or enable the emergence of diverse ways of knowing environmental issues (Turnhout et al. 2020; Cooke and Kothari 2001; Cornwall 2003; Felt et al. 2016). Scholars working in Science and Technology Studies (STS) have argued that this is because participation is often seen as a method in which actors are "integrated" which pre-defines their political and epistemic functions and identities; and as such have called for greater understanding of participation as a performative space in which its subjects (participants) and objects (knowledges) are interdependently and mutually brought into being – or "coproduced" (Chilvers and Kearnes 2019; Lezaun and Soneryd 2007; Jasanoff 2004). Various studies have examined how the roles and identities of participants do not pre-exist participation, but rather are made and shaped through participatory practices that actively create publics, for example, through the ways in which problems are defined, engagement is structured, or the ideal of participatory research is imagined (Irwin 2001; Lezaun and Soneryd 2007; Michael 2009; Pallet and Chilvers 2013; Krzywoszynska et al. 2018). However, important aspects of coproduction in participation remain under-examined. In particular it is not clear how the coproduction of actors and issues is influenced by the political contexts in which it takes place (Chilvers and Kearnes 2016).

This paper responds to these challenges in three ways. First it argues, alongside Chilvers and Kearnes (2019) that participation is not simply an instrumental

process of integration but needs to look at how epistemic agency is created. Epistemic agency here refers to the capacity of ways of knowing and their producers to gain authority in social contexts. Second, that this requires examining the embeddedness of actors and knowledge within constitutional relations between citizens, expertise and the state, which determine what kind of knowledge is seen as legitimate, and who is seen to be producing it. To this end, this paper extends the concept of "civic epistemologies" (CEs) – culturally specific ways of assessing evidence (Jasanoff 2005b; Miller 2008; Haines 2019) – to indicate the epistemic acts through which constitutional relations are enacted, thereby revealing spaces at which actor roles and issue-framings are interdependently formed. Third, the paper argues that CEs can consequently be understood as epistemic expressions of constitutional relations that manifest in the performative acts (Butler 1988) that are carried out by both marginalized and authoritative actors in society. In this way, this paper adds to the work of Chilvers and Kearnes (2019) by examining how constitutional relations shape the coproduction of actors and knowledge outcomes in participatory processes, and sites (acts) at which these influences can be intervened upon.

I make these arguments by examining the coproduction of vulnerable citizens, the state and risk expertise for governing cyclones in Odisha, India. Risk expertise arising from meteorological disasters presents a growing challenge for participatory climate knowledge-production since it frequently locates risk in external bio-physical atmospheric gases, even though vulnerable citizens experience exposure as a complex matrix of socio-economic factors (Gaillard and Mercer 2014). Understanding why this paradox persists is a key challenge of climate governance where STS insights about the coproduction (Jasanoff 2004) of actors and knowledge can intervene. The paper examines the establishment of Kantiagarh, a village of concrete bungalows

created in 2017 as part of a World Bank-Government of Odisha (GoO) project to reduce the vulnerability of marine fishers to cyclones by moving them from thatched “kutcha” houses on the shoreline to new “pucca” houses inland. Despite fishers taking part in the project, the vision of risk on which it is based is reductive and constraining: while the new village has kept fishers safer against the bio-physical threats of wind and rain, it has also increased their livelihood precarity by moving them from alternative sources of income and increasing their household running costs. Drawing on analysis of documents and interviews with fishers and government representatives, I show how CEs have sustained particular fisher and state subjectivities in tandem with representations of risk located in external bio-physical atmospheric gases, thereby reducing the futures that are imaginable for vulnerable fishers in participatory governance and upholding reductive expertise.

The remainder of the paper proceeds as follows. The next section discusses existing debates concerning epistemic agency in participation and how insights from the concept of CEs can intervene and be extended. The subsequent section gives a brief overview of the case study and empirical methods before examining: i) the acts through which CEs are performed in Odisha, and ii) how they have sustained bio-physical representations of risk together with particular roles for fishers and the state. The analysis draws out how CEs fix fisher identities, state roles, and particular visions of risk in relation to one another, thereby perpetuating reductive risk epistemologies. The paper concludes by calling for STS research to pay greater attention to the acts through which constitutional relations are performed to better understand how epistemic agency is shaped by the coproduction of actors and knowledge in participatory interventions, and hence how “democratizing” knowledge methodologies can be governed more inclusively and transparently.

Epistemic agency in participation

A central challenge of participation is that, rather than crafting more relevant and socially inclusive knowledge, it frequently exacerbates power imbalances and reiterates pre-existing dominant knowledge framings. For many scholars, this is because participatory practices facilitate the discursive reconstruction of existing structures of power (Cornwall 2003; Ferguson 1990; Li 2007; Foucault [1978] 1991) and research has called for greater acknowledgement of power imbalances to limit their effects on participatory experiences and outcomes (Turnhout et al. 2019). STS scholars however have urged more specific attention to how publics and matters of concern (Latour 2004) are made interdependently – or "coproduced" (Jasanoff 2004) – in participatory processes. This can be seen in at least two ways.

First is the question of how the way that issues are defined brings publics into being by pre-determining which actors become involved in participatory processes and what roles they are expected to perform (Marres 2007). Coproductionist scholars have examined how this process is iterative and mutual: publics and issues interdependently constitute *one another*, conceptualizing an entangled and co-dependent relationship (e.g. Felt and Fochler 2010; Chilvers and Kearnes 2019). Participation here is not simply engaging different people, but understanding how the knowledge products we make, such as graphs and spreadsheets, also constitute participating actors. Yet analysis has so far centred on discrete and situated studies of public engagement events (Michael 2016). Less attention has been directed to understanding how the coproduction of subjects and issues intermingles with the epistemic norms of negotiation in the democratic setting in which it takes place – and in particular how it is shaped by the "*political culture and constitutional relations*

between citizens, science and the state" (Chilvers and Kearnes 2016: 15). Constitutional relations matter here because they influence the tacit roles that the government and its citizens expect one another to perform as part of a society's political-epistemic contract in the governing of issues such as environmental disasters, and therefore affect how actor roles and risk expertise are coproduced (Jasanoff 2011).

Second, STS scholars have examined how actors shape their own participatory subjectivities. For example, Michael (2009) shows how publics perform *themselves* in relation to particular forms of knowledge and other publics through processes of differentiation and (self-) identification, suggesting a form of agency that emerges in relation to the context of the invited participatory space and structure. Felt and Fochler (2010: 219) see similar agency when they show how citizens "appropriate, resist and transform" the roles and identities that are assigned to them by the political machineries of participatory methodologies. Yet questions persist around where this agency comes from and how it is connected to the "places and spaces in which futures actually unfold" (Krzywoszynska et al. 2018: 795). For example, Wynne (2007) distinguishes the agency of "invited" and "uninvited" publics, suggesting that citizens who self-mobilize to contest a public issue have more agency on account of having assembled themselves according to their own concerns and meanings rather than an imposed issue-framing or normative agenda (Krzywoszynska et al. 2018). Yet, it is not always clear whether the epistemic agency of publics is enhanced or diminished by the capacity to self-mobilize. In their study of community forestry movements in Thailand, Forsyth and Walker (2014) show that, despite cognitively seeking different political outcomes, citizen actors unwittingly reify the same epistemic framings of forestry concerns as the state through hidden "discourse coalitions" (Hajer 1993). All

this suggests that analyzing co-production within participation also means asking first how it is shaped by the constitutional relations in which it takes place, and second how these contexts influence how we understand and govern the epistemic agency of publics.

Civic epistemologies as enactments of constitutional relations

The concept of CEs can intervene here by indicating sites at which constitutional relations between citizens and the state are enacted. CEs have been proposed by STS scholars as the institutionalized epistemic practices by which societies legitimize and deploy knowledge claims, and which simultaneously reflect and constitute the "dimensions of political order" that societies seek to "immunize or hold beyond question" (Jasanoff 2005; Miller 2008; Jasanoff 2010: 12). Existing work on CEs suggests how they might perform this role when they are enacted in street demonstrations, newspapers, lawsuits and public bodies (Jasanoff 2005). For example, Haines (2019) shows how the deployment of CEs by educated nuclear activists in India's variable democratic context allowed them to reshape the political and epistemic landscape; whereas under Thailand's authoritarian regime, peasants had to adopt a social code to make their protests heard which bought them political concessions at the cost of reiterating reductive subjectivities and issue-framings (Forsyth 2019). These analyses indicate how, by reflecting constitutional relations between citizens and the state, CEs are avenues through which the epistemic agency of publics can both be enhanced and reduced.

Yet the concept of CEs can also be developed. First, there are blind spots in our understanding of how CEs operate at non-national scales in settings where democratic governance is more fragile or patchy (Ottinger et al 2017; Haines, 2019)

and where knowledge production does not cognitively seek to establish a national political-epistemic regime (as with legal systems or environmental standards) (Haines 2020; Miller 2005). National disasters can be particularly illuminating case studies in this regard since, as exceptional circumstances in which every-day governance is suspended, such events instigate a realignment of democratic norms, citizen roles and desired expertise (Lakoff 2007; Collier and Lakoff 2015; Pelling and Dill 2009) generating "constitutional moments" (Jasanoff 2003, 2011) in which configurations of epistemic and political authority are rearranged, and civic epistemologies become more visible. Relatedly, there is little understanding of how CEs influence and are shaped by marginalized citizens, and their informal institutions and practices (Beck and Forsyth 2015). In response, this paper examines how CEs are performed in the "stylized repetition of acts through time" (Butler 1990: 179) to reveal how they are shaped by the more everyday acts of world-making done by marginalized citizens and government actors at sub-national scales, in every day activities that do not cognitively seek to build a new epistemic regimes. Such acts suggest alternative spaces where the agency to open, close and reconfigure futures are enacted and can therefore be governed or increased.

Materials, methods and challenges

This analysis draws on a qualitative case study of Kantiagarh, a dusty village of rows of identical concrete homes created to address the increasing cyclone risks faced by vulnerable fishers in the state of Odisha (see images 1 and 2 below). Odisha is often considered a world leader in the production and successful implementation of disaster risk expertise (World Bank 2019; Walch 2019). Located on the northeast coast of India, on one hand it is a place where publics co-exist with various hazards: high

rates of poverty, income inequality and low rates of growth compared to the rest of India (World Bank 2016) in addition to frequent heatwaves, floods, droughts and cyclones. On the other hand, following super cyclone “Odisha” in 1999 the state government adopted a specific mandate to safeguard its citizens from “natural” disasters. As such, Cyclone Odisha can be considered a constitutional moment (Jasanoff 2011) instigating the emergence of new forms of civic epistemologies of cyclone risk that form the basis of this research. The memory of 1999 is frequently recalled by citizens and government actors alike, who tell of 300 kmph winds battering the state for 30 hours, resulting in the devastating death of more than 10,000 people. The unprecedented scale of the disaster altered how risk was thought about in the state and how citizens and the government were expected to behave in times of disaster. It also led to the creation of the Odisha State Disaster Management Authority (OSDMA), which is examined here as a site at which civic epistemologies are produced and shaped.

Studying the establishment of Kantiagarh offers a way of examining the role of civic epistemologies of risk in the coproduction of vulnerable and state actor subjectivities and knowledge outcomes in climate policymaking. Its creation expresses a focus on safeguarding the corporeal safety of fishers that is symptomatic of a global trend in climate disaster risk to concentrate predominantly on bio-physical threats, despite vulnerability often being experienced as a more complex socio-economic and political phenomenon (Gaillard and Mercer 2014). It is also illustrative of the role of vulnerable people in shaping civic epistemologies: Kantiagarh’s inhabitants were consulted on the establishment of the new village and have expressed vocal ambivalence since, indicating both invited and uninvited forms of participation (Wynne 2007). Their influence in shaping the disaster expertise that governs their lives

indicates how constitutional relations affect the coproduction of identities and knowledge outcomes.

The research is based on ethnographic fieldwork carried out between May 2019 and March 2020. This involved gathering policy documents (including disaster management plans, post-disaster reports, and NGO reports), newspaper articles, participant observation at government offices such as OSDMA, attendance at the UN Post Disaster Needs Assessment (PDNA) conference in Bhubaneshwar following Cyclone Fani in May 2019, three focus groups with fishers living in Kantiagarh, and 45 semi-structured interviews with fishers, fishing trade union leaders, community leaders, NGO workers, and government officials. The interviews with Kantiagarh's residents were undertaken during walks around the village, during which I was shown the (as yet unopened) school and doctor's office, various homes, and the distance to the beach. Other discussions took place inside homes (where women residents showed me the kitchen, bathroom and living area) on doorsteps with children playing nearby, outside the village shop, in the courtyard outside the school and in the dusty shade of tall trees growing on the edge of the village. As such, these discussions took place within Kantiagarh's "life". Interviews with government officials took place in government offices and meeting rooms, meaning official documents, photographs and videos were often readily at hand to support statements. Despite this institutional setting, these conversations were frequently frank and informal, with interviewees reflecting upon challenges and perceived weaknesses in government policy. That said, such expressions of self-evaluation and reflective growth are also indicative of the institutional culture of the OSDMA which is consciously self-appraising. Trade union discussions happened in Bhubaneshwar, in homes, community spaces and during beach walks, and often seemed guided by party political agendas.

Image 1. “Pucca” homes in the new village of Kantiagarh

Source: author

Image 2. “Kutcha” homes where residents previously lived on the beachfront, and which are now used for storage

Source: author

The inhabitants of Kantiagarh who were interviewed were mostly men (25 out of 31), aged between 25 and 40 (18 out of 25), with families to support. Four of the men interviewed were older than sixty and fished solely for their own subsistence. As is common, the women interviewees were not fishers, they cared for children and the home, and sought informal manual labor work nearby. Interview questions with fishers focused on how risk is experienced. These included open ended questions such as “what makes you feel vulnerable to storms” and “what would reduce this vulnerability”, These were supplemented by multiple choice questions such as “on a scale of 1-5, how supported do you feel by national government, state government, trade unions, friends and family”. Often the same kind of question was asked in various ways to account for translation and to elicit deeper reflection. Government employees were predominantly asked open-ended questions such as “what factors make fishers vulnerable to storms”, “what does the government do to address the risks faced by fishers” and “given infinite resources, what would disaster risk policy look like”. Because of their openness, such questions acted as jumping off points for deeper conversations, revealing discourses around what risk means, where it comes from and how solutions are thought about.

Interviews with the fishers and focus groups were carried out with the help of a local translator, as a mixture of Oriya, Telugu and English was spoken; all other interviews were carried out in English, which is widely spoken in India. This presented challenges when interpreting meanings. For example “climate change” was often used by fishers to refer to local changes in weather patterns, while government employees used it to refer to a political-ecological phenomenon with an assumed globally agreed upon meaning. As such, situating statements in the broader context of discussions was important to ascertain their significance. A second challenge was the expectation

that, as a foreigner, I could assist fishers politically or economically, and so free prior and informed consent was important to obtain before all interviews and focus groups. At the same time, I became aware that as a woman I was not expected to be in a position of power which led to an increased level of trust and openness. All names have also been changed to protect interviewees. All interviews were transcribed on the day of interview and, along with other documents, subjected to discourse analysis (DA), reflecting the study's interpretivist approach (Fairclough, 2016; Hajer and Versteeg, 2005). DA is particularly useful for identifying CEs because it situates them in their historical and social context and captures their fluidity and interactional quality, as in DA, meaning "never solidifies, but is constantly the object of political contestation" (Hajer and Versteeg 2005: 177). This detailed empirical material informs analysis of how civic epistemologies emerge, are sustained, and shape the coproduction of actor roles and knowledge outcomes in Odisha's cyclone governance. The following sections examine i) how CEs are performed in the everyday acts of fishers and state employees; and ii) how civic epistemologies shape the coproduction of these actors and risk expertise.

Odisha's civic epistemologies

> *"We are staying here for shelter only, not life" (Saroj, Kantiagarh resident, 40).*

> *"Vulnerability is all about giving them [coastal villages] a safe shelter. Pucca houses are disaster resilient – and this is the first priority. Life first*

then we think about livelihood. And for life we need houses" (Ramesh, OSDMA officer).

These two quotes are reflective of the central difference between discussions with Kantiagarh's residents and government employees: while for Ramesh "life" means corporeal safety from physical harm, for Saroj it entails and requires more than "only" this. All discussions with fishers and government employees reflected these different understandings of "life". For example, a common complaint from OSDMA officers was that fishers wish to remain in their homes even when a cyclone alert has been issued. As one OSDMA employee, Pradip, described, "when [Cyclone] Phailin hit some people voluntarily went to the shelters, others had to be mobilized, and others had to be forced." For Pradip, and other OSDMA officials, "mobilizing fishermen is the biggest challenge." Yet, focusing on forcibly moving fishers misses and invalidates the complex socio-economic reasons why they want to stay. That is, many fishers explained that they prefer to stay in their homes because it is their only asset and they want to guard it from looting in the hours immediately preceding and after the storm. For fishers, the risk of losing this asset takes precedence over the corporeal risk to life. This mismatch between government focus on *moving* fishers, and fisher desire to maintain their way of life is reflected in Saroj's simple statement that literally being "alive" is meaningless unless they can also pursue their socio-cultural and socio-economic "lives".

These different approaches to life also manifested in criteria for the construction of new pucca villages built by the Odisha Disaster Recovery Project, a World Bank-GoO funded program for reconstructing coastal housing and complementary improvements of public infrastructure and services. The primary focus here is to

deliver physical safety from harm. As Kanchan, an OSDMA official involved in the project explained, “fishermen don’t want to be far from the sea, but being near to the sea makes them vulnerable.” Here the only recognized form of vulnerability is the physical form that comes from proximity to the high tide line; the fishers “wanting” to be close to the sea is implicitly less relevant and important. The result is that one form of vulnerability (bio-physical) is addressed at the expense of others (social, cultural, and economic). Indeed, discussing a new project in Puri (a coastal town near the capital, Bhubaneshwar, that was badly affected by Cyclone Fani in 2019), Kanchan told me that they were currently deciding “which sites are vulnerable,” which is determined by two criteria – the desire of the beneficiary to be relocated, and the tenability of the land – “whether it is in low lying areas or might flood, needs columns or pillars or sand filling.” As Ramesh’s pithy quote indicates, the physical-corporeal dimensions of vulnerability take precedence over their socio-economic determinants, creating a binary between two supposedly distinct types of vulnerability, rather than regarding the two as interrelated. In this way, focusing on physical safety “then” livelihood support legitimates government inattention to these more complex determinants of exposure.

So where does this physical-corporeal civic epistemology of life come from and through what practices is it sustained in Odisha’s risk governance? As discussed above, 1999 was a constitutional moment through which new CEs emerged in Odisha. The establishment of OSDMA turned disaster governance into a political activity for the first time, establishing an arena in which new relations between citizens, the state and risk knowledge could be developed through newly institutionalized activities. Simultaneously, this changed how risk was understood: as Suresh, a senior OSDMA employee noted, “1999 was a turning point in thinking about risk: before 1999

everything was relief-centric, there was no preparation … [it was] a paradigm shift." Since then, two key activities have performed and enacted this epistemology – weather prediction and building physical infrastructure – reflecting and constituting a physical-corporeal understanding of vulnerability.

Weather prediction carried out at the Indian Meteorological Department (IMD) is a central epistemic activity of constituting cyclone risk as a physical phenomenon in Odisha. As Ashok, an OSDMA employee explained, "community preparedness is based on communication of weather warnings … In case of a cyclone, OSDMA receive[s] the warning from IMD, analyses it, and if necessary, bombard[s] the area with SMS." The Early Warning Dissemination System (EWDS), a series of 120 towers along Odisha's 300 mile coastline, seeks to "establish a fool-proof communication system to address the existing gap of disseminating disaster warning up to the community level" and to "save the lives and property of inhabitants who are vulnerable and under risk" (OSDMA 2016).

This emphasis on weather prediction as a key strategy for keeping fishers safe was reflected in all the interviews with government officials. In discussions at the PDNA after Cyclone Fani, prediction was repeatedly and explicitly connected to the provision of physical safety: "prediction is very important. It enabled 1.5 million people to be evacuated…all disaster management activity is dependent on forecasts" (Mina, Senior OSDMA official). The activities of weather prediction constitute disaster risk as a function of linear cause and effect – they reify the existence of an identifiable and bounded source of harm (wind speed and direction, wave height and water levels), thereby excluding other more complex matrices of causality. Here, risk becomes fully captured by meteorological descriptors, mathematical and logical representations of phenomena that are external to the socio-political and human condition, yet

nonetheless analyzable and understandable by humans. Vulnerability is then simply and linearly solved *through* these descriptors. What risk *is* here is rendered unquestionable by the focus on rational linear visions of communication to reflect the rational linear vision of cause and effect. In this way, the scientific activities of generating the numbers, graphs and meteorological diagrams of weather prediction at the IMD, and the technological artifacts and practices of the EWDS all become sites at which bio-physical civic epistemologies are performed.

These weather-monitoring practices and technologies and the focus on building physical infrastructure reflect and enact constitutional relations between citizens and the state in Odisha. First, the purely physical representations risk constitute vulnerability as something that is separate from politics, rather than embedded within and caused by it (for example through lack of socio-political entitlements). Locating risk in wind and rain and concrete walls gives the state the role of protecting citizens *from external nature*, rather than an actor partially responsible for their exposure to livelihood vulnerability. This means that the state is not positioned as an actor that should provide social or economic support for the complex livelihood effects of cyclones. Instead, the state and fishers become connected through their shared exposure to nature, joined in a common project of resisting its forces; rather than the state as a separate entity that should provide economic support *to* its citizens.

Second, these representations of risk reflect a historically-imagined national identity in which the state is expected to achieve scientific and technological advancements on behalf of its citizens. In this relationship, the state becomes a symbol of national pride based on techno-scientific achievements; it is remote and impressive, using its specialist expertise on behalf of the nation. For example, the practice of meteorology on the IMD website, is traced to philosophical writings on cloud

formation of the Upanishadas, who lived in India around 3000 BC, tracing the roots of weather prediction science to the deep historical roots of the nation. Readers of the website are also told that the Brihat-samhita (an encyclopedia written around 500AD) "provides a clear evidence that a deep knowledge of atmospheric processes existed even in those times;" while modern meteorology is traced to the invention of the thermometer under British colonial rule, giving the practice its "firm scientific foundation." That is, meteorology here reflects and embodies the historic essence of India's scientific national identity, and constitutes a role for the state as the purveyor of that coproduced identity and expertise. Meteorology is also vehicle for the state to lead its citizens to scientific advancement and geopolitical prestige: "India was the first developing country in the world to have its own geostationary satellite, INSAT, for continuous weather monitoring of this part of the globe and particularly for cyclone warning" (IMD website, accessed 2021). Meteorological renderings of risk here reflect and produce constitutional relations of the scientific state leading its disaster-vulnerable citizens into a progressive future.

Third, these meteorological methods and practices also perpetuate a paradoxical tussle between certainty and uncertainty – between scientific man and capricious nature – that reiterates the constitutional relationship of the state protecting its citizens from depoliticized threats with advances in scientific measuring. On one hand the numbers, charts and maps through which wind speed and rainfall are represented suggest phenomena that can be described with surety, yet on the other hand the unpredictability of "mother nature" was a proverb frequently reiterated by meteorologists and disaster management experts. This ambivalence was a recurrent theme of conferences following Cyclone Fani in May 2019, in which the "unusualness" of a cyclone at that time of year rubbed up against the state's meteorological expertise:

“despite [its unpredictability] Fani was helped by a very good forecast, it was 100% accurate – all disaster management activity is dependent on forecasts” (Mahendra, senior OSDMA official). This tension between untamable nature and man’s technological quest to understand and control it encourages a sense of a limitless need for ever better science and technology and authorizes the state as the key holder of that expertise.

The second disaster mitigation activity that co-performs physical risk epistemologies with constitutional relations is the focus on building “robust structures at the coast [that are] based on meteorological issues” (Ramesh, OSDMA officer). These practices are specifically connected to the priority of protecting corporeal safety: many government officials reiterated that the cyclone shelters meant that during Cyclone Phailin in 2013, “despite lots of property loss, human loss was minimal” (Mahendra, OSDMA). Similarly, the focus of the $225 National Cyclone Risk Mitigation Project, was on how building evacuation roads and bridges and strengthening embankments would “avert devastation” and enable “one of the most successful disaster management efforts in the world” (World Bank 2013). Constitutional relations are refracted through these epistemic practices and disaster mitigation activities. There is an explicit distinction here between physical-corporeal harm and socio-economic vulnerability: “human loss” is recognized and measured in terms of numbers of living or dead, not the extent to which the (for example economic) quality of that life has been diminished. The state here is expected to protect citizens physically, but not economically from nature, enacting particular constitutional relations of expectation and responsibility.

This section has examined how CEs of risk are performed in the context of cyclone governance in Odisha and how these practices reflect and constitute relations

between citizens and the state. It has shown how bio-physical and meteorological understandings of risk, in which expertise gains legitimacy by being described through wind and wave measurements and solved through physical infrastructure, scientific advancement and technological development, are performed through weather prediction and the building of physical infrastructures. The daily practices of measuring wind speed and direction by IMD and OSDMA staff and symbolic artifacts such as the EWDS and cyclone shelters all enact these civic epistemologies, and also establish and reflect constitutional relations between the state and society. In these relations, nature is characterized as an external threat, separate from political society, and human risk as a physical rather than socio-economic phenomenon. The state's role is to respond to "nature", which works to depoliticize the causes of harm and carve out specific roles for the state as protector and disseminator of information, and the citizen as victim and receiver of expertise. The next two sections examine more closely how this civic epistemology constitutes specific expected roles for the state and fisher-citizens, and how these roles serve to reinforce reductive visions of fisher futures in times of increasing climatic change.

Coproducing the disaster state with reductive visions of risk

> *"The most important thing is saving lives… The warning ensures that no one goes fishing" (Suresh, OSDMA).*

> *"IMD vindicated over Phailin prediction, proves wrong foreign forecasters" (Economic Times, 2013).*

In a government office in Bhubaneshwar, Odisha's capital, an OSDMA officer is discussing the risks faced by fishers on account of cyclones and how the government addresses them through weather warnings. On his desk is a newspaper clipping from a 2013 edition of the Economic Times, in which the headline celebrates the IMD's skilled weather-forecasting for saving the lives of citizens during Cyclone Phailin, which struck the state in October 2013. These two quotes encapsulate one of two roles the Odishan government is expected to perform during cyclones: the safe-guarder of life *above all else*. They are representative of how all interviewed government employees discussed their role in disaster management. That is, government legitimacy was specifically tied to its capacity to deliver material and corporeal safety from harm during disasters through meteorological forecasts – *direct* responses to *physical* threats. For example, Chhotray (2014) describes how after Cyclone Phailin the Odishan government "acquired a new halo overnight" for its evacuation programme. Approximately 1 million people were moved in an operation overseen by the army and navy in which it was forbidden for anyone to stay in thatched homes in coastal areas. Government authority here derives from a specific subjectivity that is directly tied to the civic epistemologies of risk discussed above: its role is about responding to risk that is natural and apolitical with physical feats of moving citizens out of corporeal danger. As the Disaster Management Minister said at the time, "we are fighting against nature. We are better prepared this time, we learnt a lot from 1999" (Surya Narayan Patra, quoted in BBC 2013).

The interdependence of this subjectivity of physical protector with bio-physical risk epistemologies, such as those enacted through weather monitoring, derives partly from the authority that this coproduction of knowledge and identity bestows upon the state. This is indicated in external discourses of the government, for example from

International Non-Governmental Organization (INGO) reports and newspaper articles. Newspapers often reported the logistical feat of saving lives with no attention to more complex dimensions of livelihood vulnerability. Frequent tropes involve the “death toll” and the logistical feat of moving hundreds of humans – “shifting more than 10 lakh people to safer places” (The Hindu 2013). Similarly, the World Bank applauded how, “the state government and OSDMA…identified safe buildings, constructed new shelters, charted evacuation routes, established evacuation protocols and strengthened coastal embankments.” The government’s role of saving life *above all else* here through physical infrastructure and temporally immediate response activities is a huge source of political legitimacy. Indeed, the political subjectivity of the state is built upon responding to the visible and immediate effects of storms that can be directly linked to meteorological forces of wind and rain, which works to sustain this reductive vision of vulnerability.

Odisha’s CEs establish this role for the Odishan government as physical protector of corporeal life on both a national and a global stage. As the opening quote suggests, in global settings, this role sticks due to its capacity to convey prestige upon the whole of India, by “proving foreign forecasters wrong”, such that the Odishan government’s identity as an expert in meteorological forecasting delivers political authority to the whole country. Yet, in national settings too, this identity distinguishes the Odishan government. Odisha is one of the most economically poor states in India, and accustomed to critique over its development and governance indicators. However disaster management is the area in which the state stands apart from the rest of the country. OSDMA provided the institutional and normative blueprint on which the *National* Disaster Management Agency (NDMA) was created in 2005, and OSDMA officials are proud of the authority that this heritage bestows. As Bishnu, a senior

OSDMA official commented to me, “OSDMA aims to be the leader in disaster resilience in India and the world.” Bringing physical safety to Odisha’s citizens through infrastructure and evacuations here forges legitimacy for the government of Odisha *within India and Odisha,* which is accustomed to being critiqued for its socio-economic indicators. That is, while the state may fail to deliver *economic* development, it *is* able to save lives.

This subjectivity is accompanied by a second: the state as *morally* required to provide physical and corporeal safety from nature’s unpredictable effects. This can be seen in historic laws that form the basis of the state’s disaster governance. The 1994 Odisha Relief Code (ORC) and 19th century Famine Codes outlined the duties of both citizens and government in the provision of relief (Dreze 1994; Chhotray 2014) and detailed specific identities that are to be adopted by the state and citizens. For example, the state is morally bound to assist “victims” and acts as a “sympathetic and concerned entity with a clear moral obligation to provide relief” (Chhotray 2014: 217). At the same time, citizens should make “concerted and continuous efforts to fight a common misfortune” (Odisha Relief Code, quoted in Chhotray 2014: 219). The deserving victim is one who is blameless, who has tried to improve their situation, but for whom harm was an unforeseeable and unstoppable force of nature. The state bestows relief as a gift, in response to this external force. These roles directly reflect Odisha’s physical, corporeal and meteorological CEs of risk: the state is expected to provide *physical* relief to citizens, whose victim identity is derived from the *external* and *naturally* occurring character of the disaster, which renders them and the state blameless. Indeed, as Mohan, a retired OSDMA employee noted, fishers are “at risk because of nature and so are always given immediate relief.” Relief here is not given according to political norms of economic or sociological justice, rather the CEs

discussed above work to exclude this role for the state, since it derives such political currency from addressing *nature's* wrath. The political legitimacy of the state requires that vulnerability is bio-physical. This subjectivity hence directly reflects the distinction in Odisha's CEs between socio-economic and physical risk. This government subjectivity thereby produces, and is produced by, a particular civic epistemology in which material and corporeal safety come to stand in for *all* causes of exposure. Indeed, as Suresh, a senior OSDMA official noted, "the principle learning from Fani is that we need more shelters. We cannot predict where the next cyclone will come from, so we need to have multiple shelters."

Coproducing the disaster citizen with reductive visions of risk

> *"people do [fishing] not to make a profit, but because they want to live on it" (Trinath, 33, Kantiagarh resident).*

> *"In the old village we had many livelihood programmes. Women could get work there. This was good. Now we are very far from that. Now they are house-wives, staying at home. So the household has less money" (Atharbatia, 30, Kantiagarh resident).*

This section discusses how Odisha's CEs have shaped two specific identities for its fisher citizens that have worked to uphold reductive visions of cyclone risk. The first quote above is indicative of one of those subjectivities, and is a discourse that underlay the majority of the discussions with Kantiagarh's residents: that fishers have not historically regarded fishing as a commercial activity, and hence do not feel entitled

to make political demands for socio-economic benefits. Kantiagarh's fishing community has not historically connected political citizenship with economic support for fishing for various reasons. First, marine fishing developed in Odisha in the second half of the twentieth century – much later than in other Indian states with marine fishing communities such as Kerala, meaning their identification with Odisha as a political home is not well established. Moreover, these communities have since remained not just politically distinct, but culturally separate too, for example speaking Telugu instead of Oriya. Second, Odisha's marine fishing communities are ancestrally migrants from Andhra Pradesh and West Bengal who arrived in the 1930s and were allowed to stay and continue only because they did not pose any economic competition to the freshwater fisheries, nor cause any political problems for the government. As a result, there has been little political mobilization to make demands of the state to support their socio-economic needs. This is particularly reflected in land tenure: in most new villages such as Kantiagarh, fishers do not own their new homes because they are built upon government land. This leads to a sense of detachment from the rest of Odishan society: "unlike the other citizens, fishing communities are in transit here" (Basu, Kantiagarh resident). Many comments arising from a focus group held in the shade of the school courtyard reflected this feeling of disconnect and exclusion from Odishan politics: "the government throws us from place to place. Very easy. One day the government may throw us to London" (Ajay, Kantiagarh resident); "people have rights but the government doesn't feel that they have rights. Our rights are secret. We are always exploited by political parties" (Maheswar, Kantiagarh resident). Third, fishing among Odisha's marine fishers has historically been a subsistence rather than a commercial activity (again, contrasting to other states such as Goa, Kerala and Maharashtra) meaning these communities rarely seek commercial support from the

state. As the quote above indicates, fishing has not historically been a commercial activity, “if they catch one fish they are happy” (Trinath). These three factors contribute to marine fishing in Odisha developing only a weak form of political organization, especially when compared to counterparts in Kerala, where fishers are politically organized to demand their rights based on socio-economic needs (Kurien 1995).

What are the implications of this for understanding the effects of civic epistemologies on the coproduction of roles and risk expertise? The disinclination to make political demands for economic support that has historically characterized the identity of Odisha’s fishers shapes – and is shaped by – Odisha’s civic epistemologies of risk which separates physical from socio-economic dimensions of vulnerability. According to this subjectivity, Odisha’s fishers do not politicize their livelihood concerns, and in this way, civic epistemologies of risk work to fix them in a role of not significantly mobilizing for socioeconomic support in times of disaster. Being held in this role perpetuates a framing of risk that is dominated by physical understandings of vulnerability and the exclusion of socio-economic visions of exposure.

The second fisher subjectivity that upholds and is shaped by Odisha’s civic epistemologies of risk, is the expectation that they require social “modernization” in the form of physical improvements to their living conditions. For this reason, despite protesting how Kantiagarh has reduced incomes through its expensive cookers, lack of farming space, and distance from alternative forms of labour, the new village of Kantiagarh has been legitimized as a sufficient disaster response on account of providing symbolic “modernizing” gains. During one group discussion of 9 fishermen, the Santosh, who was 60, described how things have changed in his lifetime: “in the past there was no difference between dogs and children, if a child had a wound it would get licked by dogs and be cured. Now things are different. Fishermen do not

wear traditional dress and there are more clothes, food and desire for things." When asked if they would rather move to a different place closer to work, a resident in his early thirties called Dillip, wearing a t-shirt saying "experience consumption" responded that he was "very happy with [his] Western-style house." For women residents, the positives of Kantiagarh were often linked to its provision of "hygienic" living conditions. Yet "hygiene" here means more than bacterially clean, but was connected to broader conceptions of contemporary living. Sabita, a mother of two in her mid-twenties described the new houses as being, "modern, like a Western village."

Here the "ideal of the hygienic housewife and mother" (Ikeya 2010) and the notion that "modern" water creates "modern" women (O'Reilly 2006) were prominent in interviewees' satisfaction with Kantiagarh. Hygiene here is an identity, a subjectivity that counterbalances, and even legitimizes the livelihood disbenefits of living in Kantiagarh. That is, they may have fewer opportunities to do alternative labor, but the prestige of the "modern" home is attractive – and supportive of a bio-physical vision of cyclone risk. Residents also frequently referred proudly to the benefits of having a new school and doctor's surgery, despite both having remained closed due to lack of staff for the 18 months since the village was opened, showing the precedence symbols of development often took over material assistance such as socio-economic support. This subjectivity of expecting the government to give them "modernizing" benefits in the form of physical artifacts like cookers and infrastructure reflects the bio-physical civic epistemologies discussed above.

Nevertheless, Kantiagarh's residents were also aware that these subjectivities also fix them in a situation that inhibits the socio-economic transformation of their lives: "we will stay here, but there are no livelihoods…the government knows people want to go because here is not sustainable to live" (Basu). There is a sense here of being

trapped and constrained socio-economically by policies that have been set up to protect them materially and corporeally from cyclones, and that have misunderstood the complexity of their livelihoods. There is also an acknowledgement of the compromise – a bargain – based on a subjectivity that is expected to be grateful and accepting of physical modernizations and that should not make political demands for livelihood assistance in the face of "nature's" risks. Yet a fear also exists that these compromises are not only making fishers more economically vulnerable, but leading to a form of perceived cultural hollowing, as more and more fishers migrate for work. As one fisherman explained, "here we don't have any jobs, so are bound to this place and occupation. That's why there is no change. One day, fisher community will be washed away, destroyed. In two decades it will be gone." This risk policy, reified by CEs that fix the state and Odisha's marine fishers in particular subjectivities, produces a profound sense of stasis and disillusionment that is the antithesis of the transformational futures so much participatory policymaking seeks to conjure.

Conclusion: Advancing participatory outcomes by examining CEs

How can participatory forms of policymaking better understand the coproduction of publics and matters of concern in order to deliver more inclusive and relevant expertise? This paper has sought to address this question by extending the concept of civic epistemologies to indicate epistemic practices where constitutional relations are enacted, and demonstrate how these relations can fix actors in specific subjectivities that uphold reductive environmental risk expertise and prevent alternative more transparent approaches from gaining traction. Participation is often regarded as "democratizing" policymaking and "transforming" futures, especially in the governance of urgent climate risk. This paper argues that for participation to deliver

such outcomes, greater attention needs to be directed to how participating publics and matters of concern emerge interdependently through contested political contexts. This adds to various debates concerning epistemic agency in participation.

First, it adds to work that examines participation as a vehicle of discursive control by indicating how different ways of knowing risk gain authority among different publics. Agency here does not just operate *through* knowledge, but the way issues are understood also influences how actors emerge in participatory contexts. This has particular implications for development contexts in the Global South, where the inclusion of marginalized citizens is often regarded as the key to developing expertise to generate transformative futures. This analysis shows that epistemic agency does not just reside in the marginalized communities or state actors engaged in participatory interventions, but in the shared assumptions that determine what form of knowledge is authoritative and who is seen to be producing it.

Second, this paper has added to work on CEs by showing how un-cognitive localized acts of knowledge production, including by marginalized citizens, are sites at which CEs are performed, and constitutional relations between citizens and the state emerge and are sustained. In Odisha, CEs are enacted in the in the daily, localized activities of making graphs, charts and bulletins of weather forecasts, and in technologies such as the EWDS which represent risk as an unpredictable force of nature external to human society. They are also performed by Kantiagarh's fishers in their use of "modern" cookers, the *in*capacity to do alternative labor, and playing on the walls of the closed new school building. Yet these measurements, activities and artifacts are also sites at which constitutional relations between risk expertise, citizens and the state are co-performed. For example, the purely bio-physical representations of risk constitute vulnerability as something that is separate from politics, and the state

as the safe-guarder of victim-citizens from nature, which discounts disruption that is caused by pre-existing socio-economic vulnerabilities – and the state government's responsibility for them. Moreover, these acts show how CEs can operate in non-cognitive and non-transparent ways to coproduce actor roles with unwanted knowledge outcomes. It is likely that such localized expressions of CEs will represent fluid sites of constitutional change in Global South contexts, where democratic regimes are more patchy and contested. Nevertheless, further research could usefully investigate the extent to which local acts might represent opportunities for shaping CEs in more established democratic orders.

Third, this paper has added to coproductionist work on participation (Chilvers and Kearnes 2019) by demonstrating how the effects of constitutional relations between expertise, citizens and the state can be examined through the concept of CEs. Existing coproductionist research has examined how publics and matters of concern constitute one another, but often without incorporating the role of wider political cultures. Yet these contexts have important effects. For example, the co-production of the state's role as safe-guarder of life rather than livelihoods and a reductive vision of risk indicates how Odisha's civic epistemologies, which validate renderings of exposure as physical, corporeal and external, forecloses the capacity to think about vulnerability also as a longstanding socio-economic and political phenomenon. This has various implications for how agency in participation is considered and governed. First, while previous research has suggested that "uninvited" publics have greater agency than "invited" publics, this paper has suggested that the constitutional relations that characterize those contexts can mitigate as well as enhance that agency, by fixing actors in roles that uphold reductive issue framings. This means that practices that seek to democratize knowledge by

bringing together different knowledge-producers need to consider how their subjectivities are forged interdependently with local epistemic structures, to understand the political and knowledge outcomes they produce.

This also has practical implications for participatory methodologies. Rather than focusing on *how* to integrate knowledge users, practitioners might pay more attention to the knowledge that is produced – and their own role in shaping it – to examine the extent to which knowledge *outcomes* reflect existing epistemic hegemonies – and why. This would entail a multi-stage process. Analysis of knowledge outcomes after the first round of participation might draw attention to dynamics such as hidden discourse coalitions or civic epistemologies, whose sources and implications could be discussed in further rounds of group deliberation. Making visible such unseen epistemic alliances could make marginalized citizens aware of sources of epistemic disempowerment, and thereby engender the production of alternative knowledges. More generally, this research suggests there is a need to be more reflexive about what roles we expect participants to perform and why, whether those roles are achievable, and what *kind* of knowledge and political outcomes we want participation to deliver. All these questions are sites of political contestation and constitution.

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Democracy in a Deluge:
Epistemic Agency amid Fractured Politics

Abstract

Despite repeated calls for grassroots participation in climate policymaking, the epistemic agency of marginalized voices remains little understood. While local knowledge is increasingly regarded as an antidote to top-down climate expertise, it often ends up reinforcing dominant framings of risk. Such outcomes affect how scholars analyse key STS concepts such as civic epistemologies (CEs). CEs have been understood as the cultural criteria by which societies validate knowledge claims, yet it remains unclear how they mediate epistemic agency when the civic is not a cohesive liberal democratic body. In this paper I examine how the work of CEs is achieved in the context of hurricane governance in Puerto Escondido, Mexico, where vulnerable fishers constitute a socio-politically and economically excluded part of a fragmented civic. I argue that understanding CEs as expectations of democracy can indicate how they mediate the co-production of knowledge and political order in such settings, and hence the ability of fisher epistemologies to be heard. In Puerto Escondido, the audibility of risk knowledge is filtered by fisher expectations that the government will behave corruptly, and government expectations that fishers prefer to remain socio-economically separate from the state. Examining expectations of democracy can also inform upon two other little-understood aspects of CEs: the conditions under which they are fluid and mutable, and the extent to which their effects are desired and cognitive. The analysis indicates why many attempts to include marginalized voices in climate policymaking might fail to live up to their desired outcomes.

Introduction

Clemente, a fisherman from Puerto Escondido, Mexico, is standing by his boat on a 3 kilometer stretch of white sandy beach, throwing scraps to pelicans as he sorts through cool boxes after a night at sea. It's 6am and we are talking about Hurricane Paulina, which made landfall here in 1997. I have been asking him about changes in government management of the storm and hurricane risks that local fishing communities face along this coastline:

> "They do nothing," he says
>
> "But don't they issue weather warnings?"
>
> "Yes, but they don't support us! They close up – they're just closed. They want a profit – they're always going to look for a profit for giving support."

Clemente's words reflect experiences that are multiplying across the world: as the effects of climate change generate an increased risk of storms and hurricanes, more and more people find themselves living increasingly vulnerable and precarious lives. Yet the key concern here is not just the rising incidence of storms, but that policies for addressing storm risk are not believed to be attending to the needs of citizens like Clemente. For Puerto Escondido's fishers, the government's focus on reducing the *physical* risk to life through weather warnings is insufficient – and at worse exacerbates their livelihood precarity – if it fails also to deliver socio-economic support for how the warnings prevent them from earning a living.

How can climate expertise be made more relevant to those who depend on it most? For many scholars of environmental politics, the answer lies in bringing neglected political voices in to climate policymaking[5] (Chambers 1995, 2014; Fischer

[5] The drive to include marginalized voices in policymaking has been expressed in a variety of concepts and terms, including instrumental knowledge co-production, the democratization of expertise, transdisciplinarity, integration,

2000; Reed et al. 2014; Beier et al. 2016; Chilvers and Kearnes 2019; Turnhout 2020). Underlying this literature is often the assumption that local voices are key to generating "new narratives of life and culture" (Escobar 1996: 65) that can challenge dominant epistemologies of climate expertise, and all that is required is to "allow [conventionally excluded] discourses to speak for themselves" (Peet and Watts 1996: 34). Yet more critical work has complicated a necessary linear connection between local knowledge and the disruption of dominant ways of knowing issues such as climate risk (e.g. Mosse 2019; Cooke and Kothari 2001). This work has shown that calls for marginalized actors to "speak truth" to policymakers often ignore current structures and institutions of colonialism that prevent these voices from being heard or received by relevant audiences (e.g. Spivak 1988; hooks 1990; Sharp 2009; Liboiron 2021). Knowledge here does not travel as an "immutable mobile" (Latour 1986), but rather its social stickiness depends upon it finding resonance with the (often contested and unjust) political contexts in which it is embedded (Mol and Law 1994; Law and Singleton 2005). Moreover, there is no pure form of local consciousness that can be disentangled from its political context (Spivak 1988), rather (epistemological) acts of "resistance" are always "partly implicated in the very systems of oppression they set out to oppose" (Hale, 2006: 98), complicating the search for a local epistemological silver bullet. Indeed, research at the interface of political ecology and STS has cautioned that local knowledge might actually replicate or reinforce existing dominant epistemologies. For example Forsyth (2004, 2019a) shows how critical social movements often form "discourse coalitions" (Hajer 1995) with state narratives, leading to the reification of hegemonic environmental imaginaries, or "songlines of risk"

deliberation, and participation, and from a range of fields including environmental politics, development studies, and social-ecological systems (SES). Scholars have noted how much of this work's focus on methodologies of inclusion risks depoliticizing how knowledge gains authority in society by implying it is a technical linear process (Chilvers and Kearnes 2019; Turnhout et al. 2020).

(Jasanoff 1999) that are “sung into existence by each new episode of activism” (Forsyth 2004: 393). Other research has shown how well-known examples of environmental resistance such as the Chipko movement in Uttarakhand India have become co-opted into wider ecological concerns of international environmental NGOs (Jackson 1995) and regional politics of statehood (Rangan 2000). In this way, local knowledges might unwittingly uphold existing dominant framings of risk while cognitively advocating alternative agendas (e.g. Forsyth 2019b).

These debates raise important questions around how to understand the relationship between dominant epistemologies and local voices in climate governance. How are the roles and capacities of marginalized citizens as epistemic agents co-constituted with authoritative ways of knowing issues such as climate risk? The concept of *civic epistemologies* (CEs) is particularly relevant here. As the cultural criteria by which knowledge is deemed usable and reliable (Jasanoff 2005; Miller 2008; Haines 2019) CEs mediate the capacity of certain ways of knowing phenomena such as climate change to gain authority in diverse social settings. For example, research has indicated that the criteria by which societies in different Western liberal democracies legitimate claims by biological science vary widely despite being presented via the same scientific statements (Jasanoff 2005). At the same time, there has been little research on how the epistemic work of the *civic* in validating (or not) truth claims is achieved – and with what effects – in locations not characterized by formal and dependable channels of deliberation and knowledge-flow between citizens and the state (Haines 2019). What epistemic agency do marginalized citizens have in these contexts, how is that agency mediated, and with what effects?

In this paper, I propose examining the civic through citizens’ *expectations of democracy* to understand how CEs mediate the epistemic agency of marginalized

actors[6]. These expectations can be understood as mutually-constituting anticipations of behaviors and roles by publics and the government. As such, expectations indicate how dominant epistemologies shape and are shaped by marginalized civics in non-cognitive ways via the interdependent and intersubjective anticipatory vectors through which democratic settings are constituted between citizens and the state. In this way, expectations ground CEs in the performed workings of highly variable democratic settings, bringing attention to the broad sets of relations that constitute and uphold dominant cultural knowledge-ways and the acts through which they are repeated (Butler 1988). Examining CEs as civic expectations in Oaxaca reveals how marginalized fishers non-cognitively reiterate dominant CEs of hurricane risk by performing particular civic roles based on these expectations. Analyzing expectations also advances thinking on CEs by indicating conditions under which they might be mutable and fluid and have undesirable political effects when expressed through fractious and contested state-society relations.

In the next section, the paper develops the utility of expectations of democracy to STS thinking on CEs by discussing how existing literature has engaged with the epistemic agency of marginalized civics thus far. The paper then examines the criteria for authoritative risk knowledge in Puerto Escondido, and the practices and artifacts through which they are articulated. Showing that fishers uphold and shape risk CEs through the mutually co-constituted expectations of the government and the codes they must express to ensure membership in their own politically marginalized

[6] In this paper I use the term “marginalized” to refer to citizens who have little involvement in mainstream political, cultural, social and economic activities, either because they are excluded from them or because the democratic setting has few “mainstream” characteristics. In this sense, marginalized actors are involved in a contested relationship with the democratic state. Marginalized is used rather than “subaltern”, in recognition that not all marginalized actors are subaltern (Spivak 1988) yet, acknowledging that subaltern actors are often marginalized, this analysis seeks to be relevant to analysis of the visibility of subaltern knowledge.

community, the analysis indicates how their expectations of democracy become a conduit for geophysical risk epistemologies. A concluding section discusses the implications of this research for generating risk expertise that is more relevant to the needs of marginalized groups.

Civic epistemologies and epistemic agency

The concept of civic epistemologies complicates the proposition that grassroots voices can necessarily challenge dominant framings of climate governance. CEs have been used to refer to the "social and institutional practices by which political communities construct, review, validate and deliberate politically relevant knowledge" (Miller 2008: 1896; Jasanoff 2005, 2011a; Morvillo 2020). These practices might include "styles of reasoning, modes of argumentation, standards of evidence, and norms of expertise that characterize public deliberation and political institutions" (Miller 2008:1896). As such CEs act as a filter, mediating the democratizing capacity of grassroots knowledge by acting as gatekeepers to the visibility – or authority – of different ways of knowing issues. In this way CEs are also sites at which civic epistemic agency is enacted[7]. Indeed, existing research has indicated two vectors through which this epistemic agency might flow: in their characteristics and effects (what forms they take and how these mediate the epistemic agency of different ways of knowing) and the practices in which they are enacted (how they are shaped and sustained in democratic societies). For example, Jasanoff (2005) details five dimensions of CEs that condition how political societies respond to scientific claims, including dominant participatory styles of knowledge-production, methods of accountability, and registers

[7] The concept of CEs was first developed by Jasanoff (2005) partly to address the lack of civic agency inherent to a "deficit model" of science communication, by highlighting the role of civic epistemic cultures in validating (or not) scientific truth claims. The nature of civic epistemic agency is therefore at the heart of the concept.

of objectivity; and how they are sustained through performance and reperformance at sites where the politics of knowing public issues is contested and staged, such as newspapers, demonstrations, public hearings, lawsuits, electoral administration, and environmental indices (see also Miller 2004, 2005; Kunelius and Yagodin 2013). As such, (at least) two opportunities exist for grassroots actors to have epistemic agency via CEs: in their capacity to *shape* and *deploy* them.

At the same time, examining the epistemic agency of marginalized actors also presents certain challenges and opportunities for the concept of CEs. Much work on CEs has tended to examine the civic as a space of membership to an established (usually national) liberal political citizenship that has access to due process and institutionalized forms of deliberation through which it makes claims to government over trajectories of techno-scientific developments (Jasanoff 2005; Miller 2004; Daemmrich 2004; Felt and Muller 2011). As such this civic has various expectations over its political-epistemic context, including "relatively unblocked channels of knowledge flow…among nodes of public engagement within the state, private sector, academia, media, non-profit organizations and legal domains" (Haines 2020: 4) and the confidence that governmental bodies will respond to their demands, complaints and concerns (e.g. Hilgartner 2000). More recently however, scholars have begun to examine how political communities at the sub-national scale (e.g. Tironi et al), activists (Pereira et al. 2018; Haines 2019), subaltern groups (Haines 2020) and politically marginalized communities (Forsyth 2019a) engage with CEs. For example, Haines (2019) examines how nuclear activists in India draw upon CEs to make their claims heard by powerful state authorities, while Forsyth's (2019b) analysis of forest governance in Thailand shows how in the context of an essentially authoritarian regime, forest communities bought in to reductive socio-epistemic codes to make their

needs heard. In these cases, CEs mediate the epistemic agency of marginalized citizens via those citizens *deploying* pre-existing CEs, rather than through their capacity to *shape* them. As such, it remains unclear how knowledge-makers on the fringes of the civic seeking to disrupt epistemic hegemonies might not only utilize existing CEs, but contribute to their formation.

Examining the engagement of marginalized citizens with CEs also addresses the relationship between epistemic agency and democracy within the concept. CEs are conceptually grounded in a view of democracy in which "contests over policy-relevant ideas and facts are an essential element of democratic politics" (Miller 2008: 1897). This has led some research to associate CEs with "lively public debate" (Hennen and Nierling 2014: 44), or evidence of a flourishing democratic sphere, by which citizens are able to hold government to account by putting checks on its knowledge-claims. (In some cases, this has prompted scholars to regard enrolling and fostering CEs as a goal of policy and analysis (e.g. Phadke 2010; Donovan and Oppenheimer 2016)). Yet to what extent do CEs enhance or reduce the epistemic agency of marginalized actors in a civic sphere complicated by socio-political inequalities and contestations? To what extent can CEs be considered democratizing in these contexts?

For example, some research has associated absence of democracy with absence of CEs (Acero 2010). While for Haines (2020: 5) CEs become expressions of "the political-cultural manifestations of the epistemic relationships between the bourgeoisie and the regulatory state" and hence "another manifestation of the hegemony of the state and civil society". That is, for marginalized citizens, CEs reflect the "necessary political fiction" (Ezrahi 2012) inherent to modern democracies that "modern conceptions of individual freedom are accessible to marginalized groups",

becoming a space in which these citizens have no membership or epistemic agency. Yet other research presents a more ambivalent picture of epistemic agency arising from messier civic settings. Returning to Forsyth's (2019b) examination of the adoption of CEs by forest communities in Thailand, a trade-off emerges in which deploying CEs both enhances their epistemic agency on one hand (in terms of getting their needs heard) but reduces it by simultaneously reifying norms of appropriate community culture and reductive facts about forest hydrology. These debates raise questions as to how the relationship between CEs and the epistemic agency of marginalized civics should be theorized in fragmented democratic settings.

Examining a broader, more contested civic sphere might also expand understanding of other aspects of the effects and characteristics of CEs. For example, considering a more fractured and contested civic can speak to important questions around the extent to which they change, in what ways and under what conditions (Iles 2007); and the extent to which they manipulatable, how and by whom. For example, Miller (2008: 1898) writes that CEs are:

> "relatively stable, in that they persist over relatively long periods of time, often embedded in institutionalized epistemic, social and political practices. But they are also dynamic: open to change through novel processes of co-production that link epistemic, social and political contestation and innovation" (Miller 2008: 1898).

For Jasanoff (2005: 260) "shocks of exceptional severity" are needed to precipitate changes in epistemic culture. At the same time, work on environmental standards has shown how CEs have been shaped by NGOs (Iles 2007) and sustainability indicators

(Miller 2005). It could also be that in political contexts where the civic is a more fluid and contested sphere, CEs will reflect these conditions and operate with fluidity and mutability. But if so, then how? And do actors change them deliberately and cognitively, or does this shaping happen in more passive un-cognitive ways, perhaps having unexpected or undesired effects (e.g. Forsyth 2019a)?

CEs as expectations of democracy and the epistemic agency of marginalized actors

In this paper, I propose examining CEs as *expectations of democracy* in locations where the civic is not a cohesive liberal democratic group but might be characterized by features such as patchy membership, contestation, socio-cultural and linguistic heterogeneity, clientelist networks and exclusion. Expectations of democracy can be understood as mutually- and relationally-producing expectations of the roles of government institutions, citizens and the socio-political order, temporarily constituted and shaped through epistemic artifacts and performative acts (Butler 1988). STS scholars have examined how expectations have constitutive effects in the context of biomedicine (e.g. Hedgecoe and Martin 2003), but their effects have not yet been studied in relation to CEs and the epistemic agency of marginalized actors. Yet the concept presents various opportunities for addressing the questions raised above.

First, expectations suggest ways in which marginalized citizens might shape as well as deploy CEs, by foregrounding the vectors of belief and anticipation by which democracy is a "social achievement" of embedded practices, rather than a pre-given, fixed political landscape (Miller 2001: 455). That is, different groups will have different expectations of the socio-political order called democracy and what it can provide to them, which both shape the characteristics of CEs, and how they mediate the epistemic agency of the citizens who use them. Secondly, expectations indicate how

the work of the civic is done by broad, messy and contested sets of relations, which might condition the agency of knowledge producers in unexpected and non-cognitive ways. On one hand this is because expectations are not always consciously enacted but are often tacit or unconscious. Moreover, in distinction to much work at the interface of epistemology and *imaginaries*, expectations do not necessarily indicate a *desired* collective future (Jasanoff 2015), but may be regarded as unfair, undesirable and/or uncontrollable. For example, expectations might arise surrounding desirable outcomes (such as welfare assistance) or undesired political dysfunctions (such as corruption). On the other hand, expectations have multiplying and dynamically constitutive effects as actors apply them to themselves and one another, suggesting how a "subtle network of compromises" (Orwell 2004 [1940]: 22) might compound one another. Expectations thus make visible how epistemic agency is expressed and shaped through and by citizen expectations in settings where the civic is not cohesive, conditioning the capacity of their knowledge to be articulated and received with authority.

Thirdly, examining expectations of democracy indicates how CEs might be characterized by fluidity and change, by drawing attention to the specific networks of anticipations, beliefs and trust that constitute a democratic order, and through which the criteria of epistemic credibility emerge. Expectations refer to ways in which the "social dimensions of the self's formation as a subject-citizen require and generate an openness to its continual renegotiation of its boundaries and affiliations in relation to a variety of (often incommensurable) groups, networks, discourses and ideologies" (Honig 1996: 275)[8]. In this way, they indicate opportunities for and dimensions of flux. That is, in emergent and patchy civic communities, spaces and moments at which

[8] Understanding social identity as a function of social relations is particularly important when they are increasingly treated as a fixed and essentialized conduit for social transformation (e.g. Gosnell et al. 2019; Marshall et al. 2012).

political orders are negotiated are based upon expected outcomes and a belief that certain things are owed to you as a citizen (such as welfare), and certain things you just have to put up with (such as corruption). In such contexts democracy is an epistemological process, not just a political setting. As such, expectations become spaces at which epistemic orders emerge, conditioning the agency of different knowledge-producers to be heard.

The remainder of this paper examines CEs as expectations of democracy in the context of storm governance in Puerto Escondido, Mexico. In order to do so, it addresses the following questions:

1. What are Puerto Escondido's civic epistemologies of risk and how are they enacted?
2. How do expectations of democracy shape CEs and hence the epistemic agency of marginalized fishers?
3. How can thinking about CEs as expectations of democracy increase understanding of the democratization of expertise through grassroots knowledge?

The paper examines these questions through a study of hurricane risk governance in Puerto Escondido, Mexico, where expertise relating to vulnerability appears unchallengeable by local fishers who are exposed to its effects.

Case study: Hurricane risk and the epistemic agency of marginalized fishers in Puerto Escondido

Hurricanes, CEs and democracy in Puerto Escondido

Climate risk governance presents specific opportunities for analyzing expectations of democracy and the epistemic agency of marginalized citizens. At the same time, “much remains to be done in developing civic epistemology as a lens through which to understand environmental policymaking” (Iles 2007: 373). Large climate events such as hurricanes bring particular attention to the role played by expectations of democracy in mediating the epistemic agency of marginalized citizens. Such events often involve the suspension of democratic norms in the name of responding quickly to extraordinary circumstances (Lakoff 2007) and so can be considered spaces of democracy-in-flux, or “constitutional moments” in which “basic rules of political practice are rewritten, whether explicitly or implicitly, thus fundamentally altering the relations between citizens and the state” (Jasanoff 2011b: 623). These alterations are fertile conditions for the renegotiation of entangled political and epistemic norms: with new expressions of political governance come new descriptions of who is at risk and why, indicating conditions under which CEs might emerge and change. They also suggest spaces and moments at which marginalized citizens shape CEs through negotiations over the political order.

The experiences of Puerto Escondido, Oaxaca are illustrative of the interaction between civic expectations concerning the political order, and risk expertise. Mexico has one of the highest incidences of environmental hazards in the world and is a prolific producer of risk expertise through the National Centre for the Prevention of Disasters (CENAPRED) and the National School for the Civil Protection (ENAPROC). At the same time, Mexico’s political order is a space of flux and contestation. Democratic governance is a key goal of the Obrador government elected in 2018, yet a historic lack of institutional accountability and popular mistrust of government corruption challenge government authority at local and federal levels (Salazar 2007).

Indeed, research has shown low popular support for government institutions, and scholars have argued that elections have historically been ritualistic and unconcerned with outcomes (Ai Camp 2012; Smith 2012; Eckstein 1990).

Oaxaca has a particularly contested relationship with Mexican democracy through its history of rejecting official state governance. The state is characterized by social diversity (58% of the population speaks an indigenous language compared to the national average of 15%) and substantial political decentralization (it is divided into a vast 570 administratively autonomous municipalities yet based on population and national average should have only 66), 75% of which are governed through *usos y costumbres*[9] (Sanchez, Hinojosa and Wright 2018). The legal recognition of these traditional community practices in 1995 was the outcome of protests by indigenous groups against the construction of a $478 million development (Mattiace, 2012), and since then *usos y costumbres* have come to represent the self-determination and autonomy of indigenous groups, and the possibility of realizing alternative imaginings of democracy within the Mexican state (Stolle-McAllister 2005). At the same time, STS research on the politics of environmental expertise in Oaxaca has shown how indigenous communities and government officials "collaborate in making knowledge and ignorance" thereby upholding deficient dominant epistemologies (Matthews 2008: 492). Oaxaca hence provides opportunities to understand how contested and fractious citizen-state relations can indicate both cognitive and non-cognitive epistemic collusion.

[9] *Usos y costumbres* literally means "uses and customs" and is often used to refer to the laws of Indigenous communities in Latin America. Such localized forms of self-governance and juridical practice are officially recognized in Oaxaca. The term's history has been traced to colonial rule of Latin America in which Indigenous peoples were subjected to distinct legal procedures. In this way it has been associated with a form of alienation and othering as well as independence and protection (Rabasa 2010).

The following research examines how fishing communities from Puerto Escondido, Oaxaca contest official government expertise that their hurricane risks should be addressed predominantly by addressing bio-physical kinds of harm. That is, while the government prioritizes preventing fishers from going to sea to keep them safe from the physical impacts of wind and waves, fishers argue that this policy exacerbates their livelihood vulnerability by severely constricting their incomes. Indeed, this concern reflects current debates in climate risk governance, which seek to understand why socio-economic aspects of vulnerability have little epistemic authority despite this being how many communities experience risk (Gaillard and Mercer 2014).

The analysis is based upon ethnographic fieldwork carried out between January and April 2019. Policy documents relating to storm governance, newspaper articles, and attendance at government disaster management conferences, in addition to 42 semi-structured interviews with fishers and government representatives in Puerto Escondido and the city of Oaxaca provided the empirical material. Interviews were carried out in Spanish, recorded with informed consent[10], and transcribed on the same day, and all the names of the fishers and government officials have been altered. This empirical material was then subjected to discourse analysis (DA) (Fairclough 2016; Hajer and Versteeg 2005) which is appropriate for examining CEs since it positions them in their socio-historical context and indicates how they are interactionally fluid alongside their socio-political contexts, as in DA, meaning "never solidifies, but is constantly the object of political contestation" (Hajer and Versteeg 2005: 177). Using these methods, the next section examines the criteria of epistemic credibility about risk knowledge and the practices through which they are articulated in Puerto

[10] This involved explaining the nature of the questions and the research that the information they gave would become part of.

Escondido; while the following sections analyse how the epistemic agency of bio-physical visions of risk are shaped by the mutual expectations of the town's fishers and government.

The criteria and performance of Puerto Escondido's civic epistemologies of risk

Conversation with government official:

- *"What are the main challenges you face in governing the hurricane risks here?"*
- *"Here, first and foremost we regulate saving the human lives of people who go out in the boats. The biggest challenge? It's making them understand the dangers… But then, they do understand the dangers, but the other risks they face are greater, so they go anyway"*

Conversation with Mario, fisher:

- *"Do you fear storms?"*
- *"One problem is that when there is a big storm we can't go to work. Another is that the cold fronts affect the fish. The fish hide on the other side because of the cold…"*
- *"Do the warnings help?"*
- *"The information bulletins inform us about hurricanes, which means we can't go to work – to fish – for 3,4,5,6, days… Storms affect us because when they come we can't go out to work, so we cannot earn. That's how it is".*

These two quotes illustrate how official hurricane risk expertise in Puerto Escondido is characterized by a bio-physical approach to vulnerability despite fishers experiencing it as a socio-economic concern. That is, the way that vulnerable people know and experience hurricane risk in their daily lives has little epistemic authority in political society here. For the government official, keeping fishermen "safe" from storms requires keeping them out of the sea; yet for fishers, this approach exacerbates their livelihood precarity because it means they cannot earn. Federal, state and municipal authorities carry out different aspects of hurricane governance in Puerto Escondido, yet all focus on safeguarding fishers from physical corporeal harm. This section examines the acts, artifacts and discourses that sustain and perform this *bio-physical* civic epistemology of risk, and what happens when they are enacted.

Perhaps the most potent discourse through which these geophysical CEs of risk are articulated is that of vulnerability as a function of *natural* weather patterns. When asked about the risks faced by Puerto Escondido's fishing communities, municipal and state authorities nearly always responded about the inevitability of hurricane season: "the risks that we have are natural – that every year, there is the rainy season that lasts from 15th May to 30th November" (PE municipal officer). Similarly, when asked who was to blame for hurricane *risk*, all fishers responded that no one was to blame because this risk was "natural". Hence for both there is a slippage between the meteorological causes of hurricanes and the causes of human exposure *to* hurricanes. This has various effects. On one hand it depoliticizes harm by implying that it is the unavoidable outcome of capricious nature. On the other hand it reifies an understanding of risk as *physical* impacts, rather than say, social, economic, or psychological exposure. At the same time, this discourse has a different meaning for fishers compared to government actors. While for the government *nature* is to blame

for harm, for the fishers *no-one* is to blame for harm because these weather patterns are natural processes that can't be helped. That is for the fishers, the weather (nature) is something that humans inevitably must live *with,* whereas for the government weather is something humans can and must be protected *from*. And while for the fisher there is little separation between humans and nature, for the government this separation is a core justification for their risk policies of protecting human from it.

This dominant discourse of risk as naturally-occurring in the physical environment is performed through weather prediction, warning systems and evacuation protocols. These activities are carried out by both government actors and by fishers who are legally required to obey risk protocols. As a senior official at the civil protection explained, "understanding and mapping deep cloud structures is the key to minimizing risks". Risk here is *meteorological* (not socio-political). Mapping the weather, and the artifacts and activities that accompany these processes uphold and shape a civic epistemology of risk as a physical, mathematical, mappable and ultimately apolitical phenomenon. The physicality and objective register of these artifacts and practices also works to render the question of what risk *is* settled, not open to debate. For example, when asked about the causes of hurricane vulnerability, nearly all government officers responded with a detailed description of *how* storms and hurricanes are generated: "if a storm is forming – and the majority are formed in the Caribbean and then gain strength in the Gulf of Tehuantepec, which is the most famous cyclonic zone in the pacific (and all the tropical zones that form here will become hurricanes) then, depending on the magnitude or the evolution that it has, we begin to alert the population" (civil protection officer). Such descriptions of risk-as-meteorological phenomena rolled off the tongue, rendered fixed and unquestionable through their performance and reperformance in trainings and the testing of protocols,

and evinced in the undeniable shared experiences of bad weather. Fishers also reify these visions of risk-as-weather through their legal obligation to participate in policies of weather communication and security, such as the receipt of SMS warnings, obeying the red warning flags that are put out on the beach when a storm is predicted, and the life jackets they must carry on their boats. Putting on life jackets, seeing and responding to the red flag, and receiving immediate updates of the weather via SMS are all acts that reinforce a fear of the weather as the source and locus of harm and hence uphold this civic epistemology of risk as a physical rather than an economic experience.

Laws and protocols are hence important sources of the performance of Puerto Escondido's CEs. Indeed, the government often expressed this CE of risk-as-weather in terms of citizen responsibility and tendency to obey port laws. For many government employees, law obedience and physical safety are inseparable: "we try to protect the lives of the fishers, and mainly this is done by ensuring that they obey the law…We monitor and ensure that the boats have their registration and their safety kits to protect themselves – vest, windshields etc." Following hurricane protocols is hence the solution to hurricane risk: "since Hurricane Paulina, the people now know what they have to do when we emit meteorological bulletins, and they adopt preventative measures. It's a shame that this misfortune had to happen for them to listen." Fisher vulnerability becomes a function of their acceptance or rejection of government authority here. Not obeying the law, not taking responsibility for yourself, and not properly understanding the risks that you face all become synonymous problems of fisher behavior that *cause* exposure hurricane risk – and reiterate a vision of risk as an exogenous, direct physical threat to the body, rather than something that is endogenous to political society. At the same time, the law's focus on the necessity of

safety kits reifies a particular temporal dimension of risk: risk happens in the immediate moment that the storm is happening, not the vulnerability that has been generated via long term socio-political histories (and for which life jackets would be little use).

Lastly, geophysical risk epistemologies are articulated through language that is concise, straightforward, structured and scalable and thereby communicable without ambiguity as to what the risk is. This linguistic style grants authority to physical visions of hurricane risk by rendering them simple, one-dimensional and incontestable. Examples include basic meteorological updates expressed through graphs, tables, diagrams and numbers. This simplicity also makes a physical epistemology of risk mobile and scalable, as these numbers and graphs can be quickly input into hurricane protocol and communicated via linear strategies and technologies such as loudspeakers, SMS, radio, posters and television broadcasts. A geophysical risk epistemology is thereby converted into simple and minimal language, which disseminates this (supposedly) unambiguous expression of risk. For example, the enactment of pre-defined dimensions of hurricane vulnerability via prescribed descriptors in the hurricane protocol rests upon simple codes and signifiers that work to reify a physical vision of risk. As the Port Captain explained, “if [the hurricane] intensifies, every six hours, it is a constant monitoring from when they start, to when they form as tropical depressions, to when they turn into tropical storms, and hurricanes. Then we put a number – 1,2,3,4” (Port Captain). The notion of safety as corporeal, temporally bounded and apolitical is reified here through tables, maps and colour coding. When asked about hurricane policy, ten out of thirteen officials interviewed recited the communication strategy, some tapping their fingers, exasperated, to indicate the incontrovertibility of this risk truth. As one government employee said frustratedly, “we explain all of this with very small words, so that people

understand. That is to say, they are not difficult terms. We explain it with simple words. Also when we give training, depending on who we are talking with, we use different language so that people understand". The articulation of risk through such simple expressions as tables and maps here does not only create a depoliticized physical vision of vulnerability, but also implies that it is incontestable: the problem is that people just won't listen – or can't comprehend the language.

These three dimensions of Oaxaca's CEs require risk to be expressed as natural, physical and meteorological, assured via obedience to government protocols, and communicated via simple linguistic signs, graphs and tables that are simple and detachable. They thereby exclude more complex, socio-political, and temporally distributed visions of vulnerability that aren't so easily reified or communicated. The next section examines how these civic epistemologies are produced and sustained through the expectations that fishers and the state have of each other within Puerto Escondido's socio-political order.

Fisher expectations of democracy

What expectations do Puerto Escondido's fishers have of the socio-political order in which they carry out their lives and livelihoods? And how do these expectations shape their capacity to influence CEs, indicating CE emergence and fluidity? The fishers interviewed expressed seemingly contradictory sentiments towards their democratic government. On one hand, the majority were passionate about the importance of voting in elections, because it signified a moment to freely express desire and agency, and was also a way of performing a more positive "democratic" Mexican state into existence. On the other hand, as interviews progressed, corruption became a focus of nearly every discussion, bringing with it a deep sense of frustration of trusting politicians and cynicism towards the electoral

process and the socio-political order in general. This coalesced around two interrelated sets of expectations about the democracy in which they saw themselves as embedded, which paradoxically worked to lend legitimacy to a bio-physical CE of risk that they cognitively found problematic: (i) that seeking help from the government was *futile*, and (ii) that fishers should maintain their *independence* from government as much as possible.

A sense of futility in seeking support was a key theme in fisher discussions of the risks they faced from storms. This feeling was derived from an expectation that the government would always behave to corruptly to serve its own economic needs, and since they were poor, fishers stood no chance of making the government listen and respond to their demands. Asked about how the government could help them, many interviewees simply responded that, “politicians just help those with money”. This expectation of automatic rejection from the government is shot through with fear of violence. Speaking of his joy at the recent election of Obrador in 2018, who was elected on a promise of cleaning up national politics, one fisher noted that, “any government that wants to carry out these rights, they kill you. And this is the risk this government is running, that they are killed. The truth is, in Mexico, it’s really difficult”. For the fishers, both their expectation – and fear – of government corruption (at both a local and a national scale) means it is not worth approaching them to attain the kind of support they require to attend to their vulnerabilities. This expectation leads them to actively seek assistance elsewhere – to actively distance themselves from the government – as this remark from Jesús indicates: “they only help distinguished people, those who are connected. You might get a boat or an engine if you’re lucky. But most look after themselves. We’ll go to the bank, a company but not the government. Never the government”. This sense of futility upholds Puerto Escondido’s

geophysical CEs, because it perpetuates the notion that economic risk is something that the government will not assist with.

At the same time, this expectation does not stop the fishers from cognitively thinking the government *should* support them. Many fishers expressed a sense of injustice and frustration; and all interviewees felt acutely aware that their social contract with the government was unfair. For Luis, this was expressed in the simple feeling that if fishers obey government laws, then the government should help them in return: “we have a certificate, which we pay for, and with that credential we have the right to fish. Ok. So now we are registered with the government. They take us into account with that concept. Therefore we would like them to support us during the rainy season”. There is a sense of transactional justice here that the fishers feel the government, even if it is regarded as corrupt, should respect. At the same time, they fully expect them not to, and accept this injustice with a heavy-hearted resignation. As Mario said, “they give us very little, but what are we going to do? We can’t ask for more. You have to accept what they give you”. This gap between what is *desired* and what is *expected* shows how the concept of expectations captures unwanted experiences of risk. It also shows how expecting the government to neglect their needs prevents fishers from making more concerted demands of the authorities, since they are resigned to not receiving anything, which authorizes an approach to risk focused solely on physical safety, and not the economic support that they require. In this way, their expectations about their democratic context serve to uphold undesirable epistemic outcomes.

This sense of futility in engaging with the government about the complex risks they face often grows into a resolve that it is better to live *independently*. Luis, discussing his desire for greater support for fishers during the rainy season, indicates

this connection: “The government says it’s going to support you, it tells you it’s coming tomorrow, tomorrow they don’t come, you set yet another date, until you get angry and give up. And you ask yourself, why do I keep doing this when they pay me no attention?' This is the reality. *And then you just think I’ll look after myself*. That’s the way it is, unfortunately.” This independence often takes the form of a conscious rejection of a perceived immoral code. Discussing the role the government plays in minimizing their risks from hurricanes, José Luis commented that, “we look for ways to solve our problems ourselves…we don’t want it [government assistance] that much because then the people who have the government think that the government has them, but then they cheat and exploit you. And this is not what we want. So it is preferable not to get into all that… We earn our tortillas without any help from the government. We earn them alone”. Here, rejection of the government’s moral code is also a rejection of assistance, which upholds and shapes a CE that validates approaches to risk that do not include livelihood support. In this sense, fisher assertion of economic independence is not simply a strategy for livelihood survival – ‘don’t depend upon those who can’t be trusted’ – but also a moral identity, and enactment of this epistemology is thereby entangled with the enactment of membership into a particular marginalized civic. Ignacio made a similar comment to that of José Luis, but emphasized how independence from government is also foundational to how they see themselves: “fishing is a way of being free. We are not constrained. If we want to earn money, we give ourselves to our work, and if we don’t want to earn, we sleep and earn nothing. No one will ask us, ‘why aren’t you working?’… this is freedom. The police don’t come and tell us we are drunk so we cannot go to sea. The police don’t tell us anything. We are independent”.

This shows how the political expectations of marginalized civics concerning their own roles and identities have epistemic effects. That is, by signaling to one another their affirmation of a cultural code of independence from the state, fishers contribute to civic epistemologies that uphold physical framings of risk since, by asserting this distinction between themselves and the state, fishers reinforce an order in which their livelihood vulnerability is separate from political accountability. Their *active* rejection of government interference as a core of their cultural identity and authority shows how self-expectations of the roles that the civic should play *vis-à-vis* the state can un-cognitively reinforce undesired visions of risk.

Another arena in which the signaling of a cultural code reifies a physical risk epistemology is in fishers' expression of their unique relationship to nature. As discussed above, fishers regarded themselves as embedded within, not separate from, nature. Articulating this relationship involved articulating membership with a unique and specific civic culture. Here, nature is regarded as the pure, incorruptible opposite of Mexican politics as represented by the state and its policies on hurricane risk governance. By being in nature through their livelihood, fishers hence retreat to a space that represents freedom from a corrupt and immoral political-human existence. Nature is also a space where, through their unique connection to and understanding of the sea, fishers expressed feeling in control, in contrast to the seemingly capricious domain of corrupt socio-political life in Puerto Escondido. Another key aspect of this cultural identity involves pride in their livelihood as inherently dangerous, because this danger derives from being subjected to the sea's wild and natural forces: "it's very risky to be in nature like that, every day. It is like the lottery. If you have luck you win. But if not you will lose. You are with god every day".

Nature here represents a danger that is pure, honest and noble, in direct contrast to the danger associated with corrupt politics. Much self-worth and cultural capital is derived from being subjected to these forces. Assertion of membership to this civic via the performance of this relationship to nature meanwhile serves to uphold the dominant geophysical risk epistemology by positing nature as *the* cause of hurricane risk. In this way, the fishers' cultural code upholds a vision of risk as external, natural, physical and unpredictable, and forecloses alternative approaches to vulnerability based on the livelihood support that they cognitively desire. In this way, fisher expectations of the state are entangled with – and produced relationally with – the expectations they have of themselves as a community and the codes they must express to ensure membership in that community, which work to uphold and shape civic epistemologies of risk. This shows how CEs can work as non-cognitive epistemic structures by being embedded in networks of expectations, and thereby grant social authority to knowledge that is undesired or reductive. Yet it also shows avenues through which marginalized actors uphold and shape CEs through their tacit expectations of the socio-political order, and hence avenues through which these CEs might be altered or governed.

Government expectations of democracy

How do the expectations that the government has of itself, its citizens and the broader political order condition civic epistemologies of risk in Oaxaca? Conversations with government employees revealed that they only expect citizens to engage with a fraction of their disaster expertise. A common complaint was that citizens do not understand the risks they face, nor do they see that following government protocols helps them. This was frequently expressed as citizens lacking a "culture of protection".

As one officer in PE said, “we face many challenges, but the primary one is the *culture of the people*. We don’t have a culture of prevention. All Mexicans – all the people on the coast – say ‘never mind…there is a team that will protect us, so we don’t need to worry’…it’s the culture. We don’t have the right culture”. Yet officials also found this lack of “culture” hard to account for. Many regarded it as something that could be fixed by streamlining the vectors of communication: “the structure is there, what we need to do is permeate into society what they need to do to prepare and protect themselves” (PC Enlace Oaxaca). Others regarded it as an intrinsic psychological-cultural relationship with environmental danger – “Mexicans forget the most quickly. At the moment everyone is worried about earthquakes. Oaxacans have already forgotten the impact that hurricanes have on them. Then the earthquakes will pass…At least in Costa Rica, Chile, over there, with regards to the culture, it is there”. But when pushed on why this culture exists in those countries but not Mexico, there was a tentative recognition that this could not be blamed on inexperience of physical risks: “Yes, we have a long history of disasters, hurricanes, volcanoes, fires, explosions. Many chemical and road accidents, every day there is loss of life. But the people still don’t have the culture”.

The most common explanation for Oaxacans’ lack of culture was their tendency towards political protest. Schools were regarded as the biggest impediment to a culture of protection, which was traced to a violent demonstration that occurred in 2006 when the state governor refused to concede to teaching union demands for pay increases. Persistent mistrust between teacher unions and the government is directly reflected in the way government officials explain the lack of a culture of protection, and hence the cause of citizen risk. This is most evident in the anger officials expressed

towards teachers for withholding access to schools, hampering their capacity to create the culture they envision:

- “Twenty years ago, we started with the civil protection in the education sector. It took a lot of work, going to the schools to do the training. We managed to train just 500 schools in 15 years, out of 13 thousand.”
- “Why so few?”
- “The teaching establishment is very complicated here in Mexico. In Oaxaca it is the worst. They are against the system. Like the Irish who don’t want to be part of the island, no? Although they are obedient to an extent, they rule the roost and respect no one here. And if it is an order from above, then even less so, because they don’t want you to order them. So they don’t allow us to come into the schools.”

The expectations that government employees have of Oaxacans here shapes how they think about hurricane risk. Officials do not *expect* to be able to work closely with citizens (as attention to their livelihood needs would require), and focusing on the external, meteorological dimensions of risk articulates and maintains that distance. Addressing complex socio-economic determinants of vulnerability would require engaging in political-economic discussions with citizens, which is regarded as dangerous given Oaxacans’ propensity for political protest. Better to just focus on the apolitical task of moving them physically out of harm’s way. Hence government expectations of fishers lead them to enact dominant geophysical risk epistemologies. At the same time, the interdependence between this expectation of citizen behavior and a bio-physical CE of risk indicates how CEs are fluid and might change in relation to political contexts: shifting the expectations that the government has of its citizens

might encourage it to produce expertise that requires more trust, cooperation and dynamic involvement in their economic lives.

Fishers, as a specific marginalized and separate social group, are expected to behave with an autonomy that reflects a particular imagining of their culture and identity. For example, a government official notes that fishers “aren’t businessmen, they are pure fishers. I’ll give you a very clear example. A fisher catches a marlin. Let’s suppose its various kilos, so you say, why don’t you filet it and sell it for a higher price? But he says, no, no, and sells it to the permit-holder for much less. And the permit-holder makes a lot of money”. To the government fishers behave in an economically dysfunctional way. More specifically, the government expects fishers to behave in a way that excludes themselves from the wider national economy. When seen through the lens of hurricane risk, this expected economic independence generates a civic epistemology in which economic vulnerability is not the responsibility of the state: fisher economic vulnerability is their own responsibility, a result of their unique socio-cultural behavioral makeup, not the responsibility of structural disadvantages, and hence not improvable by government policies. Hence these expectations reify a vision of fisher economic vulnerability as unconnected to the activities of the state.

Fishers are also expected to be rule-breaking, adventure-seeking and sometimes irrational – inalienable cultural traits that government employees frequently regarded as the predominant cause of their vulnerability: “many fishers dedicate themselves to sharks, they go out 25-30 miles. They’re crazy, reckless. They will get, say, one fish. Their boats don’t ensure their safety if conditions worsen”. When asked why they do this this government official responded that, “they’re fearless. This is a word we use for people who are brave, but in a stupid way”. These characteristics are viewed as innate to who fishers are, rather than a trait that could be changed by greater

welfare assistance or a more trusting relationship with the government. To the government, then, fisher risk becomes a function of their identity and culture, rather than socio-economic factors that government policies could address. Relatedly, fishers are not expected to abide by government laws: “a fisher will say ‘I needed to do illegal fishing because I don’t have anything to eat’, but they planned to do it. I don’t know why they don’t obey the law, it’s something we have to work on”. Fishers here become a law unto themselves: “there are many who have these customs [of illegal fishing], ideology – they have done it all their lives”. In this way, government employees regard fishers as outside the civic, and therefore a social group to which more complex socio-economic assistance would not apply. There is a distance here between the government and its fisher-citizens: the government does not meddle in their lives any more than it needs to, meaning the most basic and fundamental – pure, apolitical corporeal safety. The following comment from a government official illustrates this perceived and accepted separateness as something the fishers desire: “the fishers, yes it’s complicated. They don’t want to stop doing what they want to do. So they have formed institutions like the fishing cooperatives, which were formed with the goal of making them more powerful” (Port Captain). For this official, the separation between fishers and government is “just the way things are”. These expectations of recklessness, rule-breaking and separation justify an epistemic rendering of risk as the provision of fundamental corporeal safety and nothing more.

Government expectations of citizens are also inextricable from their expectations of themselves and Oaxaca’s political order. Many officials felt that the development of Civil Protection departments was crippled by the political system of appointing its heads. As one employee explained, “the problem is that the positions are political. There’s no continuity…when there’s an election, it’s like, ‘Luis, you’ve

never worked, but work for the company! Come and be director of the Civil Protection!'" Municipal presidencies last three years in Mexico and, "in three years you can scarcely develop the programmes. Then the new person brings his new ideas and throws out the previous plans. And we start all over again. And it's a never ending story". The inadequacies of hurricane risk governance here are a problem of short election cycles and an endemic culture of political graft.

The system of *usos y costumbres* is also regarded as an impediment to proper governance of risk, as one official explained, "unfortunately the laws in Oaxaca don't function in the same way as in your country. Here we are a pluri-cultural state…the authorities arrive at an agreement with the syndicates…they generate a compromise and in return they are allowed to build in areas that are not suitable for living". Here, government employees see a limited capacity to develop more complex policies of long term structural socio-economic support, because it might be overturned by your successor or blocked through the historical political arrangements through which Oaxaca maintains its social order. Expecting the politics of the Civil Protection department to be limited thereby limits the expectations officials have for implementing different, more complex visions of risk. These expectations uphold simple, replicable ways of knowing vulnerability, for example through the repetition of protocols, because they don't foresee having the longevity to develop alternative approaches.

Conclusion: CEs as expectations of democratic deluge?

How can the knowledge of marginalized actors be made more visible in climate policymaking? This paper has argued that the epistemic agency of marginalized actors can be better understood by examining how its visibility is mediated by civic epistemologies, but also that this requires broadening our conception of what is meant

by the civic in CEs. In this paper I responded to this need by examining the civic as an arena of expectations of democracy. I applied this approach to hurricane governance in Puerto Escondido to try to understand why dominant geophysical risk epistemologies have remained unchallenged by the demands of socio-politically marginalized fishers that their vulnerability be understood as socio-economically determined. In so doing, I sought to expand understanding of CEs – and hence climate governance inclusivity – in at least three ways.

Firstly, much work on CEs has tended to explain the authorization of knowledge in society through the epistemic work of a liberal, cohesive civic that has reliable access to due process and institutionalized forms of deliberation. That is, the civic of CEs has tended to be conceived as a reflection of liberal democratic norms and institutions. Thinking of the civic instead as mutually dependent and intersubjective expectations of democracy enables the work of CEs to be examined in contexts where the civic is not characterized by these norms, but rather where democracy might be more fluid or contested. It does this by connecting how the political order of democracy is not a pre-given landscape, but rather is imagined and performed into reality through the intersubjective beliefs and expectations of those who participate in it, to the production of knowledge orders. This opens space for examining the capacity of marginalized actors – those who may be traditionally considered as existing outside a cohesive liberal democratic civic – to have the agency to shape CEs and not just deploy them. This in turn, suggests opportunities for how conventionally excluded knowledge-makers might not only utilize CEs, but actively contribute to their formation. For example, fisher expectations of government corruption creates a sense of independence and futility in seeking government support that props up the dominant geophysical civic epistemology of risk by preventing them from seeking livelihood

assistance. That is, fishers uphold the geophysical CE of risk by signaling and affirming membership of a cultural code of freedom from the corrupt domain of the state.

Secondly, examining CEs as *expectations* of democracy indicates how they might not necessarily be associated with cognitively desired democratizing outcomes. Rather than understanding CEs purely as reflections of democratizing or oppressive political landscapes, whereby citizens either have or do not have epistemic agency, the concept of expectations shows vectors by which marginalized citizens in fragmented civic spaces can shape and deploy CEs via what they anticipate from the political order in which they are embedded. This in turn indicates pathways by which less clear-cut compromises of epistemic agency might occur. Moreover, since expectations can be both tacit and self-conscious, they also indicate how CEs might have both cognitive (and desirable) and non-cognitive (and undesirable) effects. For example, fishers express a unique relationship to nature in order to give visibility to their community, yet this also works against their desire for livelihood support by reaffirming the bio-physical, apolitical determinants of hurricane vulnerability.

Thirdly, examination of democratic expectations indicates conditions under which CEs might operate as fluid and mutable. Given that CEs are embedded in institutionalized political practices, it is likely that they will be more open to change in locations where such institutions are more contested. By indicating vectors along which the civic's relationship with the government – and vice versa – might change, expectations suggest the fluidity of epistemological orders that are embedded in that relationship.

Fourth, climate change governance is a specifically useful site to examine how CEs emerge and change. Disasters are moments at which political orders are

reconstituted, involving implicit renegotiations between citizens and the state of the political-epistemic contract, and hence representing an opportunity for democratic deluge. Furthermore, citizens such as fishers are often highly vulnerable to climate disaster because of complex socio-economic and political exclusions that leave them (structurally) exposed to physical stressors. Such civics are hence sites at which CEs are contested and in flux.

This analysis has sought to show the importance of understanding how CEs mediate the epistemic agency of marginalized citizens for making climate policy more relevant. CEs indicate why simply including marginalized voices in participatory policymaking might not be enough for those voices to be heard. Yet the paper has shown that exploring the different sets of relations that might constitute the civic can bring greater insight both to how the work of CEs is achieved, and how to understand their effects. As a final consideration, broadening the civic to understand how the epistemic agency of marginalized people can be increased might also involve reflection on the role of academics in constituting and upholding CEs. Indeed, Spivak (1988: 84) argues that confronting and understanding the experiences of marginalized people requires not “constructing a homogenous Other”, which involves not representing them, but learning to represent ourselves. Many attempts to include marginalized voices fail to live up to their desired outcomes in part because of the expectations that scholars and policymakers have around the epistemic function they should perform. Including the work of academics in the domain of the civic might present opportunities for examining how our own ideas surrounding marginalization and participation circulate and with what effects.

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Liquefying Nature:
Cyclones, Epistemic Vulnerability and the Possibility of Alternative Life-worlds

Abstract

Current debates in geography seek to understand how knowledge about nature gains authority in socio-political contexts, and how this process might be disrupted to enable alternative life-worlds to emerge. Assemblage Theory (AT) has been a productive approach in this regard yet has faced challenges in accounting for fluidity and non-cognitive epistemic agency in configurations of knowledges, actors and politics. In this paper I seek to add to AT by drawing upon the concept of discourse coalitions to indicate non-cognitive knowledge processes, and the idiom of interactional co-production to analyse flux and contingency. I apply this analysis to assemblages of cyclone risk expertise in Kerala, India, where Cyclone Ockhi resulted in the death of approximately 200 fishers in 2017, and fishing communities have protested subsequent cyclone risk policies but been unable to alter official epistemologies. I show how discourse coalitions and interactional co-production both close down the audibility of fisher voices and indicate openings for alternative life-worlds to emerge. In doing so I also develop the concept of *epistemic vulnerability* within existing debates about disaster risk reduction (DRR) to capture the interaction between exposure to harm and the (in)capacity to shape expertise about "natural" risk. By indicating these aspects of fluidity in assemblages the paper suggests ways in which merely giving local people a platform to speak about their experiences of disaster risk may be insufficient to change climate futures without also understanding the politics of how their voices become audible.

Introduction: Knowing nature

On 30th November 2017 hundreds of traditional fishers from Kerala went to sea as usual, unaware that in the days that would follow many would not return alive, and those who would, would be without their boats and fishing equipment and deeply traumatized by their experiences of surviving the worst storm in the state's living memory. They would tell stories of clinging to boat fragments for hours in darkness amid crashing eight-metre waves, and their devastating inability to hold on to friends and family members. Some would say that their incapacity to foresee Cyclone Ockhi would make them too afraid to ever go to sea again.

In the years following Ockhi, Kerala's fishers would profoundly criticize official epistemologies of expertise for focusing on the physical threats to their bodies from wind and rain, arguing that simply increasing weather warnings misdiagnosed their complex socio-economic vulnerabilities and misunderstood their relationship to the sea. They would protest that government expertise hamstrings their capacity to live their desired futures: that practicing traditional fishing methods alongside alternative livelihoods in empowered, flourishing communities amid an increasing frequency of high magnitude storms was incompatible with this purely bio-physical approach to nature's risks.

In 1991 Donna Haraway described "nature" as a "coyote" – a "trickster figure" capable of "turn[ing] a stacked deck into a potent set of wild cards for refiguring

possible worlds" (Haraway 1991: 3-4). In recent years many geographers have become concerned with understanding how these trickster figures work – how authoritative ways of knowing the natural world emerge, shift, travel and stick in political societies, and how they might be disrupted to make alternative futures possible (Castree and Braun 2001; Castree et al 2014; Mahony and Hulme 2018; Soper 1998; Demeritt 2001). This is a particular concern in poorer communities, where scholars have noted that the vulnerability of local people to environmental change has often been exacerbated by expertise perceived to be irrelevant, and local voices have been unable to challenge or disrupt these dominant ways of knowing (Schipper 2020; Ribot 2009; Nagoda and Nightingale 2017). In such contexts understanding the capacity of alternative knowledges to "shape the politics of possibility in the time of climate change" (Paprocki 2022: 1) by making different futures knowable and realizable is particularly urgent, yet remains a topic of debate and deliberation (e.g. Eriksen et al 2021).

Assemblage theory (AT) has been an increasingly useful and productive approach at the heart of these debates. Scholars have used assemblages to examine how knowledge emerges through "unstable configurations of materialities and enunciations – bodies, desires, statements, discourses, strategies and so forth" (Grove and Pugh 2015: 1). AT is becoming particularly prevalent in analyses of expertise about climate change adaptation (CCA) and disaster risk reduction (DRR) (e.g. McGowran and Donovan 2021; Grove 2013; Gillard et al. 2016; Angell; 2014; Marks and Lebel 2016). A key concern for many of these scholars is the persistence of debates about the locus of "natural" risk – whether it lies in bio-physical change or the diverse socio-economic ways this change is experienced (Donovan 2016; Gaillard and Mercer 2014; Lahsen and Turnhout 2021). Drawing upon AT, some analysts have addressed this concern by examining climate risk expertise (CRE) as configurations

of “complex ideas, physical processes, physical-human interactions, human cultures and technologies that experience a varying power distribution in time” (Donovan 2017: 51).

Yet despite “tremendous conceptual inroads into human geography” (Muller and Schurr 2015: 217) there is a worry that much current scholarship undertheorizes the fluidity and changeability of assemblages, and hence how alternative epistemologies – and with them alternative futures – might arise (Muller and Schurr 2015; McFarlane 2009). On one hand scholars worry that too much emphasis has been placed on fixed arrangements between knowledge, politics, and actors, saying too little about how they interact in dynamic ways (Muller and Schurr 2015; McFarlane 2009; Anderson et al 2012). On the other hand there is a concern that work has tended to focus on cognitive epistemic agency within assemblages – how knowledge travels, sticks and clashes in deliberate and conscious ways – with less attention to how these effects might be driven by non-cognitive processes and interactions. There is a worry that such aspects of solidity and fixity in assemblages might constrain the capacity to perceive how futures emerge and can be changed through alternative ways of knowing “nature” (McFarlane 2009).

In this paper I seek to add to AT by examining aspects of fluidity and non-cognitive effects within assemblages of CRE by drawing upon the concepts of interactional co-production (Jasanoff 2004; Hilgartner et al 2015) and discourse coalitions (Hajer 1993; 1997) – and as such seek to “liquefy” assemblages of “nature.” Interactional co-production has been conceptualized as the simultaneous constitution of knowledge and political order, indicating contingent and dynamic relations between politics, discourses and subjects. Discourse coalitions refer to storylines of nature that are unconsciously shared by political opponents, lending unexpected and cognitively

*un*desired authority to certain understandings of nature. In this way they indicate hidden, non-cognitive processes of constituting "nature" within assemblages (Hajer 1993; Forsyth2019). By drawing upon these concepts to examine aspects of fluidity and change in assemblages I seek to show vectors of agency by which alternative life-worlds can be known and realized in assemblages of "natural" expertise.

I carry out this analysis through an examination of CRE in Kerala, India in the aftermath of Cyclone Ockhi – a tropical cyclone which occurred in the Arabian Sea 2017 and resulted in the death of more than 200 traditional Keralan fishers. I examine how official bio-physical representations of storm risk have persisted despite being challenged by fisher activists who have sought to highlight their socio-economic vulnerabilities. I show how their ways of knowing risk are interactionally shaped by their political marginalization; and how discourse coalitions with the state prevent their needs from being heard. I illustrate how these aspects of fluidity in CRE assemblages influence the capacity for alternative futures to emerge.

Through this analysis I develop the concept of *epistemic vulnerability* as boundary concept bridging themes of social and political vulnerability from DRR and the constitutive relationship between knowing nature and building political orders – or "the co-mingling of *is* and *ought*" – from social studies of science (Jasanoff 2012: 19). I show how epistemic vulnerability constitutes a form of exposure that both reflects and constitutes the (in)capacity to shape how environmental risk is known, and argue for greater attention to how it enables the emergence of alternative life-worlds in CRE assemblages.

The next section examines how current approaches to AT often suggest fixity and stability in relations between knowledge, politics, actors and objects; and how the non-cognitive and contingent aspects of assemblages might be theorized more

deeply. In this paper, “life-worlds” refer to shared experiences of living in the world that are created by iteratively communicated meanings (Habermas; Jasanoff 2004). They might be considered as, “areas of life typically integrated through values, norms and mutual understanding” (Flynn 2014: 206). “Expertise” is understood to refer to ways of knowing phenomena such as nature that are seen as valid in a given society (Jasanoff 2005), indicating the inseparable co-existence and contingency of socio-political and epistemic authority (Jasanoff 1990; Wynne 1992; Hilgartner 2005).

The challenge of fluidity in nature’s assemblages

Aspects of fixity

Kerala’s storms have existed for years, but have only recently been considered part of climate risk expertise (CRE). For many geographers CRE presents a growing challenge not only because it shapes how risk is experienced in the present, but because it establishes norms, values and priorities by which societies live with climate change into the future (Schipper 2020; Eriksen et al 2021; Paprocki 2022). CRE determines who is vulnerable to climate change, who is assisted and how, reflecting the needs of some at the expense of others (Feindt and Oels 2005; Eriksen et al 2021; Taylor 2014). A key concern for many analysts has been the persistence of debates in CRE about the extent to which risk lies in “extreme and rare natural hazards” driven by bio-physical change, or a lack of “access to resources and means of protection which are available to others” (Gaillard and Mercer 2012: 93). Analysts have long argued that disasters are caused not by nature’s physical impacts but socio-political inequalities that leave some more exposed to harm than others (Ribot 2014; Hewitt 1983; Cannon 1994; Blaikie et al. 2004), such that Mami Mizutori, Special Representative of the Secretary-General for Disaster Risk Reduction at the United

Nations Office for Disaster Risk Reduction (UNDRR) recently commented that "one can reasonably argue that there is no such thing as a natural disaster" (Mizutori 2020). Yet still, scholars note that "the hazard paradigm often dominates in governments" (Donovan 2016: 2). At the same time, scholars more recently have worried that an exclusive focus on social vulnerability might undertheorize the role of physical nature and therefore "could lead to incomplete explanations of causality in disasters" (McGowran and Donovan 2021: 4). These debates have accelerated calls for greater attention to *how* the domains of "nature" and "society" are not separate concerns but interdependent and mutually-generative (Latour 2007; Nightingale 2017; Castree and Braun 2001) and the role of CRE in these socio-natural processes (Hulme and Mahony 2010).

Assemblage theory (AT) has been extremely productive for many geographers in this regard (Anderson and Adey 2012; Anderson et al 2012; Donovan 2016; Grove et al 2020). Instead of presenting risk as a separate or naturally-occurring phenomenon outside of human experience, AT has focused on the socio-natural embeddedness of CRE by conceptualizing it as a "collection of relations between heterogeneous entities to work together for some time" (Muller and Schurr 2015: 220; Donovan 2016; Grove 2014b). Scholars have explained how particular visions of environmental risk such as "resilience" gain socio-political authority by "align[ing] affective relations in particular ways in order to actualize specific types of bodies – individuals and collectives with certain capacities and desires" (Grove and Pugh 2015: 3; Li 2007; Sharma 2008). Work in AT has also stressed the "conceptual openness to the unexpected" (McFarlane 2011: 654) and centrality of "the realm of *potential*" (Massumi 2002: 30), making assemblages particularly relevant for theorizing potentiality and change in the production of alternative futures (Anderson 2010). As

such, Anderson et al. (2012: 171-2) regard it as (in part) a "*concept* for thinking the relations between stability and transformation".

At the same time, AT has faced challenges in applying this potentiality and fluidity. A key concern is that many scholars "have used 'assemblage' in ways that have very little to do with potentialities and capacities, but rather to denote those stable, coherent actualisations with very little apparent flux" (Muller and Schurr 2015: 220). There is also a worry that a "focus on resultant *form*" (static) "rather than emergent *formation*" (process) (Muller and Schurr 2015: 220) "drains this terminology of its dynamic potential" (Anderson et al 2012: 173) and risks thwarting or obscuring the emergence of alternative futures (Anderson 2010; Buchanan 2015). This paper focuses on two specific aspects of this critique within assemblages: first, how meaning gets ascribed to nature, and second how diverse discourses interact to produce authoritative knowledge.

Much current research has examined the emergence of meaning in assemblages through the work of devices that "inscribe", "encode", "decode" and "territorialize", and, often thereby "render technical" aspects of environmental change (e.g. Latour 1987; McGovern and Donovan 2021; Grove and Pugh 2015; Li 2007, 2014a, 2014b; De Landa 2006). Such "inscription devices" (e.g. Li 2007) might include maps, scientific instruments or observed associations between clouds and storms that "territorialise socio-ecological imaginaries" (McGowran and Donovan 2021: 1606; Davis 2019; Davis and Groves 2019) or "fix particular types of land, and particular types of people, to a non-market niche" (Li 2014a: 34). For example, Grove (2014a: 613) discusses the "adaptation machines" that "shape the possible adaptations populations may pursue in response to social and ecological uncertainty". Such machines have entailed a "resilient community that automatically responds to

environmental insecurities without external intervention", created by "resilience programming" that "strategically encodes community relations as resources" (Grove 2014b: 249-250). Yet there is a concern that these devices might suggest a fixed relationship between their meaning and their capacity to shape assemblages, resulting in an "almost structural account" of CRE assemblages (Muller and Schurr 2015: 220). This has led to calls for more dynamic and interactional conceptualisations of relations between objects, meaning and politics to reflect more deeply the ephemerality and contingency by which meaning emerges in assemblages.

At the same time, much work in AT has examined the cognitive effects of knowledge, generating analyses of clashes and resistances between consciously oppositional actors. For example Grove et al (2020) show how two "contradictory" discourses of resilience – one that is racializing and segregating and another that critiques and challenges segregation – produce "indeterminate politics". Similarly Li (2014a: 34; 39) examines how, in response to "the use of expert knowledge in governmental assemblages" local people "disrupted or unravelled them, and sometimes acclaimed, supported or demanded them, when they were consonant with their own practices and desires". However less attention has been paid to the less cognitive effects of knowledge and discourses – how hidden connections between opposing groups shape knowledge production. Such unseen dimensions of *epistemic agency* – or, the capacity of knowledge to travel and gain social authority – are a key aspect of fluidity within assemblages through which arrangements might be reconfigured.

Making things fluid

In this paper I seek to bring more fluidity to assemblages of CRE by drawing upon the concepts of interactional co-production and discourse coalitions, and also by introducing the concept of epistemic vulnerability. Discourse coalitions have been used to refer to unconsciously shared discourses between actors who cognitively oppose one another (Hajer 1995). They highlight how epistemic agency does not always correlate to the cognitive desires of the speaking actor, but is shaped by hidden political structures and alliances that might amplify or smother it (Hajer 1997). In this sense, discourse coalitions move beyond looking at how knowledge and politics is shaped by cognitive interests, to their more concealed interactions within assemblages (Hajer 1997). For example, Forsyth (2019: 1) shows how, in Thailand's forest governance, diverse actors – including state, conservationists and activists – have upheld "unchallenged norms of appropriate community culture" which have "kept narratives about forests and society in place and worked against alternative and arguably more empowering visions." Such unconscious alliances between political opponents might indicate dimensions of fluidity and unseen opportunities to reconfigure life-worlds in assemblages.

Interactional co-production[11] facilitates the conceptualization of fluidity by examining how knowledge and political order shape one another as simultaneous and interdependent (Jasanoff 2004). With this concept, scholars have referred to "the conflicts that arise as new, emerging understandings and opportunities for change – including not only new ontological but also new epistemic and socio-political arrangements – interact with existing institutions and practices, and extant cultural, economic and political formations" (Hilgartner et al. 2015:5). As such, scholars have

[11] The term "co-production" has also referred to an instrumental process of deliberately integrating diverse actors to jointly produce knowledge (e.g. Lemos et al 2018).

used these interactional approaches to examine how assemblages of politics, objects, discourses and meanings are mutually generative, contingent and constantly in-the-making, revealing opportunities for new futures to be made.

Lastly, I develop the concept of epistemic vulnerability in this paper to refer to how the interactional co-production of politics, nature and knowledge within assemblages shapes the (in)capacity of actors to influence the climate expertise that governs their lives – and thereby effects their exposure to harm. On one hand, various scholars have sought to enhance the agency of local voices to shape environmental expertise, for example through creating spaces for local people's "discourses to speak for themselves" (Peet and Watts 1996: 34) or understanding and increasing the "basic needs and capabilities (including recognition) that human beings require to function" (Schlosberg 2012: 446). While others have noted that much environmental expertise lacks relevance to local people *even when* they are included in the processes of its production (Nagoda and Nightingale 2017). On the other hand, important work has examined disaster risk as a function of political and social vulnerabilities that create exposure to harm (e.g. Fraser 2017; Cutter et al 2007).

Yet so far, the interaction between epistemic agency and vulnerability has not yet been adequately theorized. Research on epistemic agency has tended to focus on local people as "actors" overlooking how they are produced as political subjects – which shapes how and when they can influence expertise. While important research on disasters has tended to examine "the vulnerability of science and the science of vulnerability" (Cutter 2003: 1), it has tended to do so separately, with less focus on how they co-create one another. Epistemic vulnerability seeks to theorize the interaction of epistemic agency and climate vulnerability by highlighting relations between moments, discourses, practices, politics and objects through which the

agency of actors to shape CRE is enacted. The concept has particular relevance in marginalized communities, who have often been posited as actors capable of speaking alternative life-worlds into existence if only they could be given the right platform (Peet and Watts 1996); and work that has stressed that such outcomes depend upon how political structures facilitate (or not) their capacity to be heard (e.g. Spivak 1988).

In light of these debates, the remainder of this paper addresses the following questions.

- In what ways do discourse coalitions indicate non-cognitive aspects of epistemic agency in assemblages?
- How do processes of interactional co-production indicate the contingency of the relationships between knowledge, politics, objects and actors in assemblages?
- What are the implications of these insights for the epistemic vulnerability of marginalized actors in nature's assemblages?

In what follows I examine these questions through an analysis of the persistence of bio-physical framings of cyclone risk in Kerala, India, in the two and a half years following Cyclone Ockhi.

The work is based on fieldwork carried out in Kerala's capital, Thiruvananthapuram between August 2018 and March 2020. This involved surveys with Latin Catholic Fishing (LCF) communities in the towns of Vizhinjam and Poonthura – two coastal suburbs of Thiruvananthapuram that reported the most significant loss of life after Ockhi – as well as semi-structured interviews with government officials, fishers, and members of fishing organizations such as the National Fishworkers Forum (NFF) and the South Indian Federation of Fishermen Societies (SIFFS); and relevant documents from both groups. The surveys and

interviews were carried out with the essential assistance of two Malayalam-English translators – a marine biologist from a small fishing village in Thiruvananthapuram and a journalist-activist who works on human rights in Kerala.

Assembling cyclone risk expertise in Kerala

Cyclone Ockhi was a Category-3 tropical cyclone that occurred in the Arabian Sea between 29th November and 4th December, 2017. Satellite maps depicting a clear white "eye" gliding more than 2000km northwest from the southern coast of Sri Lanka belie the 185 kilometre per hour winds that thrashed at traditional fishers in small wooden boats caught at sea. Fishing communities estimate that more than 200 Keralan fishers lost their lives in the storm, although the official figure was left at 187.

Yet the number of fatalities is just one of many controversies surrounding cyclone risk expertise since Ockhi. In the immediate aftermath traditional fishers – the only group seriously affected by a Cyclone which never made landfall – protested that the government's delay in sending rescue ships resulted in many of their friends and family members being lost at sea. Meanwhile Kerala's Chief Minister claimed that Prime Minister Narendra Modi was negligent in sending support to Kerala because it is ruled by the opposition Left party (New Indian Express 2017). At the same time the Kerala Disaster Management Authority (KSDMA) blamed the Indian Meteorology Department (IMD) for not issuing a warning in time. An anonymous government official would later explain to me that the monitoring equipment had been "closed off for cleaning" in the crucial hours that the storm was developing.

In the months and years that have followed, fishers have protested the government's "over-forecasting" arguing that weather warnings preventing them from going to sea are far too frequent and inaccurate, often resulting in unnecessary loss

of income from no fish days. Indeed, according to the Central Marine Fisheries Research Institute (CMFRI) fishers reported a massive 46% fall in fishing days in the year following the cyclone (Khadar 2021). For their part the IMD maintains that its increase in warnings reflects changes in climatic conditions. This apparent impasse has resulted in many fishers now ignoring the warnings altogether.

In what follows I examine this apparent clash between government and fisher ways of knowing cyclone risk, to try to better understand why the government persists with a strategy of frequent weather warnings, despite vocal resistance from fishers. I present an assemblage of cyclone risk expertise in Kerala consisting of the following interacting parts:

- apparently contrasting ways of knowing risk articulated by fishers and the government, performed through and represented in various activities, artifacts and symbols;
- the co-production of political order and cyclone risk knowledge among fishers and the government;
- two hidden discourse coalitions of cyclone risk between fishers and the government.

I seek to show how fluidity and interaction between these parts indicates the epistemic vulnerability of fishers: the constitutive interaction between their capacity to shape cyclone risk expertise and their exposure to harm. I also seek to show how this fluidity suggests openings and currents of epistemic agency through which alternative life-worlds can be known and empowered within this assemblage.

A cognitive clash of risk knowledges

> *"What science can tell we tell the people." (KSDMA officer, Thiruvananthapuram).*

> *"They [the warnings] are good for our life, but what will we do for food?" (Fisher, Vizhinjam)*

Since Cyclone Ockhi the government has conceptualized cyclone risk primarily as bio-physical harm to the body understandable through meteorological science. This approach is performed most visibly through the concentrated focus on weather monitoring and storm warnings. Indeed, improving weather monitoring was the first major policy response of the government which, in October 2018 – less than a year since Ockhi – converted the IMD in Thiruvananthapuram into the Cyclone Warning Centre (CWC), giving the staff there the newfound responsibility to issue warnings and state bulletins (a task previously carried out by the IMD in the neighbouring state of Chennai). The CWC is a highly visible institutional response to the specific criticism that fishers lost their lives during Ockhi because the IMD failed to warn them in time (rather than say, because of inadequate search and rescue). As such, the establishment of a building in the administrative centre of the capital filled with scientists and state of the art technologies all geared to ensuring the physical safety of bodies against wind and rain has become a concrete symbol of the bio-physical epistemology of storm vulnerability.

Various practices and technologies associated with the CWC and carried out within their offices reiterate and re-perform this vision of vulnerability. When asked how

the safety of fishers in the face of storms could be improved, one interviewee from the Kerala State Disaster Management Agency (KSDMA) responded that it was "necessary to expand the observation network – more towers are needed". For another interviewee, the cause of the substantial loss to life during Cyclone Ockhi was the insufficient computer technology producing data on storms: "to predict a cyclone you need a database or computer model, and for that you need inputs of data. It is impossible to predict without this". Vulnerability here is a function of predicting the weather – often seen as the *only* strategy for addressing fisher vulnerability. Government officials frequently emphasized more scientific monitoring of wave height, tidal patterns and wind speed, that could be translated into graphs and tables the only way to understand and analyze the causes of risk. As a result, "risk" became equated to an absence of meteorological data, and "safety" to an abundance of this information.

At the same time, risk was characterised by two-stage linear communication of this meteorological information. First, the CWC should be in constant communication with other national scientific departments about meteorological data such as the Indian National Centre for Oceanic Information Services (INCOIS) about changes in sea patterns. Second, the CWC should communicate "weather forecasts for all hazards including wind, heat, waves and rain" to the KSDMA which then "contextualizes it and issues advice to communities" (KSDMA official). Although this "contextualization" did not involve the sole responsibility to warn fishers: "warnings are a very tricky thing. We abide by warnings that are received. We cannot overrule the IMD [CWC] if it says there will be strong winds" (KSDMA official). As such risk here becomes equated to linear communication of predicted physical impacts arising from "strong winds" – the efficiency of the unidirectional flow of meteorological data.

Indeed, the focus on linear communication meant that barriers to the transmission of information – rather than say, the utility or relevance of that information, were seen as a key source of vulnerability. When asked about fisher vulnerability many government officials spoke of the inability to communicate weather updates *to* them: “the problem is that fishers go very far out and cannot be communicated with”; “the fisheries department needs to give fishers satellite phones to enable transmission” (KSDMA official; ILDM researcher). In other discussions, the problem was how communication was impeded by fisher lack of understanding of this vision of risk. One retired employee of the KSDMA explained to me that, “we need to educate fishermen more. They say, “we don’t feel winds like you say”. In Odisha and Bengal, people know what a cyclone looks like and how they feel, but not here in Kerala”. For many government officials fishers in Kerala simply did not understand the risk science being told to them.

*

Kerala’s traditional fishers vocally rejected this bio-physical way of knowing cyclone risk. In August 2018, less than a year after the death of hundreds from his community, T Peter, then Director of the NFF complained agitatedly that “the announcements are a burden for fishermen”. Peter and others have made this sentiment known in various media outlets in the years since Ockhi. The central problem is that the warnings prevent them from going to sea and so chronically reduce the incomes of both the fishers and the (mostly women) fish-vendors who depend upon the daily catch to sell at market. Fishers reported on average being unable to

work 10 days a month since Ockhi. They also believe the warnings are frequently inaccurate and too unspecific to be of use.

Yet fisher rejection of the government's expertise was not primarily about the inaccuracy of their weather warnings, but the inappropriateness of weather prediction itself as the focus for addressing their vulnerabilities. It is notable that *none of the fishers I spoke with blamed the government for failing to predict and warn them about Cyclone Ockhi*. Fishers told me that they have relied upon their traditional knowledge of the sea and weather patterns for generations to know when it is safe to go out on the boats, and have in recent years *themselves* noticed a growing inability of this own knowledge to predict storms[12] and so did not blame the government for being unable to foresee it. Rather they were angry that the government tightly followed "government protocol" and disallowed fishermen from accompanying Navy ships on the search and rescue missions. They argued many more fishers could have been rescued because they knew where their friends could be located, still hanging on to boat fragments at sea.

When asked about the risks they faced from cyclones, very few of the fishers interviewed talked about the wind, rain and waves that the government tries to communicate to them on a daily basis. Kerala's Latin Catholic fishing communities are widely regarded as the bravest in the country, and despite many being unable to swim, "are more afraid of the dogs on the beach than the roaring sea" (Kurien, interview). Rather, the risks that fishers listed included how erosion of the seashore means they cannot store their boats near their homes; the reduction in the government fuel subsidy; reduction in fish stocks due to overfishing from mechanized boats; lack of

[12] Indeed, many of the fishers who went to sea before Ockhi came from villages where the beach has been eroded, and it has been suggested that this may have further compromised their ability to read the weather.

education for their children; and lack of alternative livelihoods. Rather than more storm alerts, fishers wanted compensation for the days they cannot fish; a new harbour for their boats; a ban on the bright lights used by mechanized boats; life jackets; GPS gadgets to track fish; better access to education; a ban on alcohol consumption; and training in alternative jobs such as search and rescue. These expressions of risk indicate a more holistic socio-economic vision of precarity than those captured by a focus on weather forecasts alone.

It would be tempting to see this cognitive contrast in how risk is known by fishers and the government as a clash in which opposing epistemologies are locked in opposition within this CRE assemblage, and through which the authorization of bio-physical expertise about cyclones is impeded. Yet as I will try to show below, characterizing this assemblage of cyclone risk expertise as a clash of epistemologies hides two un-cognitive discourse coalitions between fisher and state articulations of risk which prevent fisher voices from challenging official expertise in the way they cognitively expect – and indeed serve to reify it.

It would also be possible to interpret the graphs and tables for mapping meteorological data and the satellite phones for linearly communicating this data as inscription devices, encoding a bio-physical approach to risk within this CRE assemblage. However in the next section I will examine how meanings are attributed to such artifacts and practices through the fluid and dynamic co-production of political order and risk knowledge by both fishers and government actors withing this assemblage.

The politics of knowing cyclone risk in Kerala

Seeking political inclusion in a celebrated democracy

> *"[voting] cannot change our life but if we don't vote we will not be considered as Indian citizens. In Kerala, no one controls what you eat. Today they ban beef, tomorrow they might ban fish" (Thomas, fisher, Poonthura).*

In what ways is the articulation of precarity by Kerala's LCF communities co-produced with contemporary politics? Answering this requires examining how Kerala's fishers are situated within the state's political order. On one hand Kerala is often heralded as a paradigm of democratic norms, economic welfare and inclusive political values. It is India's highest-ranking state in the Human Development Index (HDI) with over 90% literacy, 72% life expectancy and almost universal healthcare and educational coverage (Jeffrey 1992; Heller 2005; Dreze and Sen 2013). It is also characterized by "universalistic principles" of political equality and high levels of political participation (Heller 2000). Drèze and Sen (2013: 86-7) suggest that "principles of equal citizenship and universal entitlements were forged through sustained social reform movements" and reflect "people's active involvement in democratic politics". For Singh (2010: 282) Keralan society is characterized by a particular form of sub-nationalism or "we-ness" grounded in a "politics of the common good".

On the other hand Kerala's LCF communities have remained outliers in this celebratory narrative of egalitarian economic development and political culture. The coastal communities of Thiruvananthapuram are among the state's most

disadvantaged groups (KSPB 2009, Ommen and Shyjan 2014) with low rates of literacy, healthcare and education. Decreasing catch prices, dwindling fish stocks, lack of finance options, poor coastal housing, inadequate sanitation, illiteracy and high infant mortality, all contribute to the social and economic marginalization of these communities (Kurien 1995, Devika 2017, Hapke 2001). These communities are also geographically segregated, living in densely populated communities of semi-permanent structures along the coastline regarded by many Keralans as dirty, uncultured and dangerous. Devika (2017: 365) also notes that fishing communities are increasingly vulnerable to "a major shift in the role of the state away from welfarism" and towards a "mediatory role favouring predatory capital" resulting in a growing risk of dispossession to make way for new ports.

This dichotomy – between a state legitimated on universal welfarism and the marginalization of the LCF – informs how the fishers come to know and understand cyclone risk. For example, fishers seek greater inclusion into political-economic society as a way to mitigate their various vulnerabilities arising from exclusion. The quote above illustrates this: fishers vote primarily to be "considered citizens" and influencing governance comes second[13]. Their call for fishers to be trained as search and rescue professionals is not only a means of securing alternative livelihoods and education, but an indication that they are respected by being allowed to do a job in which they interact with – and rescue – all strata of Keralan citizens. As one fisher

[13] Indeed, the concern this interviewee showed over "controlling what you eat" refers to a common fear in the left-wing (Left Democratic Front (LDF)-governed) state of Kerala that that the (right-wing Bharatiya Janata Party (BJP)-governed) federal government will ban eating beef because cows are considered holy by India's majority Hindu population. The second part of the quote connects the livelihood of fishing to the distinctive character of Kerala. By critiquing the federal government's policies this fisher was signalling that he understood the political culture expected of a Keralan citizen while at the same time advocating the importance of fishing communities to that Keralan identity by positioning fishers as a deliverer of fish *meat*, and thereby indispensable to Keralan culture and the fight against Hindu nationalist politics.

explained, “because of the class system in our society, the upper class people think that we are lower class. I do not agree. We are equal...We need to live like others”.

Fisher recollections of the societal response to their actions during the catastrophic flooding that occurred in Kerala in 2018 and 2019 reflect this. Hundreds of traditional fishers self-mobilized to rescue Keralan citizens who had become stranded in their homes as rivers of water flowed through cities up and down the state. Yet fishers reported that people had not wanted to touch them and indeed didn’t trust them, despite being there to save their lives. Gradually the media came to celebrate them as the state’s saviours in its time of need, yet as one fisher told me, “we went from zero, to hero, and now back to zero again.”

Kerala’s traditional fishers expect to achieve this greater respect, inclusion and welfare within its political society by drawing upon the participatory politics that are fundamental to the state’s identity and to the government’s legitimacy. Sitting on a plastic chair on a stretch of beach in Thiruvananthapuram, in the shade of three coconut trees surrounded by fishing equipment Janet (leader of a group of women fish-vendors) and T Peter (leader of the NFF) heatedly discuss strategies for getting the government to reinstate the bus that would transport women fish vendors to and from market, and thereby alleviate their vulnerability. “How do you make the government listen?” I asked. “We gather, demonstrate, fight” T Peter replied. For Peter, “fighting”, “protesting” and “agitating” is the language of Keralan socialist democracy, and so he expects the government to attend to demands that are articulated in this way. I asked if Peter thought the government would listen. “It will, otherwise it will answer to the people…Money does not lead to opportunities, only voice does.” To speak and be listened to is the right of citizens in Kerala, and a key dimension of fisher vulnerability.

This politics of fisher vulnerability directly shapes what fishers demand. Subsidies for no-fish days directly echo the welfarist politics of the state, while investing advanced technologies for fishers are seen as a marker of social respect and validation. Not receiving them from the government is seen as an injustice in a state which has the means *and* is authorized on delivering economic equality. As T Peter told me, "in India, technology is advanced – we achieved a rocket system to the moon…now we want specific messages". This interactional co-production of how fishers know cyclone risk and how they exist in Keralan political society shows how meaning is ascribed to phenomena – or inscription devices – such as life jackets and weather warnings in assemblages in ways that are contingent, and therefore changeable and fluid. The meaning of GPS as social inclusion is not fixed in space and time, but rests upon the ways in which they are currently excluded from Keralan political society.

Making techno-science in India's outlier state

> *"The government was very embarrassed by what happened with Ockhi"*
> (John Kurien, Interview)

How is the government's bio-physical risk epistemology interactionally co-produced with Kerala's political order? The government's "embarrassment" noted above reflects its reputation for welfare and good governance, which led it to articulate a predominantly meteorological conception of cyclone risk. After Ockhi, a discourse quickly emerged of "unprecedented" and "sudden" nature of the impacts, reiterated in many interviews with government officials. This discourse focuses attention on the

physical event – wind and waves – as the cause of harm, which not only ignores but actively diverts attention away from the complex, long-standing issue of the marginalization of fishers from political society, for which the government is more accountable than an "unpredictable" bio-physical event. It establishes an exceptional-ness to the event, shifting attention away from the exceptional-ness that fishers allocate to their socio-economic marginalization. As such focusing on weather prediction addresses the supposedly apolitical issue of nature's impacts, rather than the more complex problem of the exclusion of LCF communities. As one retired government employee explained to me, "the state of the fishing communities is a long-standing problem. It's complicated; the government has never known what to do about them." A focus on linear communication of depoliticized descriptions of the weather allows it to continue not to know.

In this way, the marginalization of fishers from Keralan political-economic society legitimates government inattention to socio-economic policies for addressing vulnerability. Kurien notes that fisher marginalization gives "credibility to the perception held by political parties in the state that fishing communities were 'vote banks' to be wooed only at election time" (Kurien 1995: 87). The long-standing socio-cultural and geographic segregation of LCF was reflected in government interviewees, which exhibited a sense that the government simply did not know how or where to intervene in the fishers' socio-economic vulnerability. Interviewees variously referred to the fishers "own way of doing things," "deep cultural differences," "strong sense of independence" and the "role of the Catholic Church" in economic affairs as well as the way "money lenders control economic life" to create a sense that their life was a difficult domain to intervene in. Yet government officials not only expressed a sense that the economic vulnerability of fishers was deeply complex and difficult to solve, but that

community leaders did not want state intervention in their lives. As one official told me, "government people are not welcome there." In this context, telling fishers frequently that they cannot go to sea is an intervention that can be done from afar, without interfering in local socio-economic and political life. The way contemporary politics shapes how government actors conceptualize fisher risk here indicates the contingency and precarity through which assemblages of CRE are made – and through which alternative life-worlds become realizable.

The establishment of the CWC and focus on weather warnings should also be examined in the context of the relationship between the Kerala and Centre governments. As noted above, the Keralan government blamed the Centre for neglecting Kerala in the aftermath of Ockhi. An employee at KSDMA explained to me that, "after Ockhi [the Keralan government] demanded a CWC…and the national government agreed". As such the establishment of the CWC represented both a political win for the Keralan government in securing funding and resources from the centre, and a reiteration of failed prediction as the cause of harm. At the same time, for many employees at KSDMA (which is state-funded), the CWC (which is fully funded by the centre) was a proud symbol of the national project of science. One senior official told me that before its establishment, the IMD in Kerala was "just a post office" but that "now we have our own monitoring…now we have the best science." Another interviewee noted that "the new SOP [standard operating procedure]" was "designed by India's most capable scientists." As such the Keralan CWC became a symbol of the national scientific endeavour and the Keralan government's capacity to secure resources and responsibility from the Centre[14].

[14] See Phalkey (2013), Arnold (2013) and Mahony (2014) for discussions of the relationship between state-building and science in India.

These sections have shown the precarity and contingency of fisher and state understandings of risk: ways in which they are produced by – and produce – the local political order. The next section will examine how the apparently contrasting visions of risk of these groups do not lead to impasse and ambivalence within this CRE assemblage. Rather their epistemic agencies are influenced by two non-cognitive discourse coalitions between the government and the fishers, indicating hidden alliances and vectors through which bio-physical risk epistemologies are reified.

Local voices heard? Un-cognitive discourse coalitions of bio-physical risk

1. Nature: wild and furious

> *"Nature unleashed her fury that night" (Government employee)*

> *"No one is to blame, it was mother nature, she was angry" (Fisher, Vizhinjam)*

In discussing cyclone risk both fishers and the government shared a discourse of nature as a wild and furious force outside human control and foreseeability. For the government, this discourse serves at least four political purposes. First, a notion of "nature versus humans" establishes the human domain as a homogenous entity equally affected by nature's force, obscuring its disproportionate impact on more vulnerable groups. Indeed, the government is positioned as merely another "human" victim of nature by such a binary categorization, thereby making it less susceptible to blame. Second, this storyline defines vulnerability as a function of the physicality of

nature – nature's anger is expressed in strong winds and big waves – rather than dimensions of social and economic exclusion from Keralan political life, turning attention away from the more sociological determinants of vulnerability. As one retired civil servant from the KSDMA noted, "the government calls for construction of coastal protection measures. This has been mainly hard structures like sea walls and groynes. That is what is now practiced, evidently there are other options which we are not thinking about." Third, victims and their livelihoods become positioned as obstacles to their own safety because of how they got in the way of nature's force. A discussion with an ILDM officer illustrates this: "the problem is that people won't move away from the coastal areas, so we can't respond to the disaster." This also depoliticizes certain government policies such as the relocation of fishers away from their coastal settlements, which some fishers suggested is motivated more by a desire to "clean up" and redevelop coastal lands than protect fishers from storms.

For Kerala's Latin Catholic fishers, the discourse of nature's wild unpredictable character supported a different epistemology of risk as neglect of both fishers and nature. Fisherfolk traditionally view the sea as *kaladamma* – kala meaning "sea", and amma meaning "mother" – with deaths on the ocean often regarded as the anger of mother sea (Samuel 1998; Ram 1991). Indeed, for the Mukkova community, gales and storms are a manifestation of the furious breath of god (Samuel 1998). Rather than viewing nature and humans as separate like the government, fishers actively connected themselves to this wild furious nature, evoking an entwined and codependent existence. For example, a member of the South Indian Federation of Fishermen Societies (SIFFS) asserted that "fishers understand the sea and the sea understands the fishers", while a fisher from Poonthura stressed that "nature and

fishermen have a long history of working together." Here, the existence, flourishing, and identity of fishers and nature become codependent.

For many, cyclone risk was the neglect and marginalization of *both* fishers *and* mother sea by the government and modernization. As one fisher-activist noted, "for [the government] the coastal lands are only useful in so far as they are industrialized. Fish-workers are only important in so far as they contribute to the GDP earnings of the country. And nature is only conserved when it becomes a tradable commodity devoid of people." The discourse of nature as wild and furious invokes something that should be protected from greed and corruption – and with it the fisher way of life to which it is wedded.

Here then both fishers and the government know nature as a furious, wild, and often female force, yet attach different visions of the future to this knowledge. For the fishers this knowledge envisions a life-world in which fishers and mother sea are protected by empowering fishers socially, politically and economically; while for the government it indicates a life-world in which all humans are protected from the fury of water, wind and waves by modern technologies and modernizing strategies – a vision which leaves the socio-economic situation of fishers unchanged. This un-cognitive alliance indicates fluidity – hidden slippages and silent collusions between sliding plates of discourses, knowledges and politics. On one hand these discourses raise the visibility of fisher demands, but on the other hand they reify the policies that fishers reject. As such, this discourse coalition also produces epistemic vulnerability, as their lived experiences of Keralan politics (marginalization) leads fishers to adopt discourses (fishers and nature's entwined fate) that work against the audibility of their demands for socio-political empowerment (by reifying bio-physical discourses of nature's power as a hazard that is separate from socio-economic vulnerability).

The poster below illustrates how shared articulations of “nature” between fishers and the government become vectors of epistemic vulnerability for the fishers. “Nature” here is on one hand a celebration of the fishers’ unique relationship to the sea, indicated by their traditional dress (brought into relief by the boy in a bright football shirt) and their customary fishing practices (sorting the nets in a row on the left and pushing out a painted wooden boat on the right). At the same time, “nature” is a commodity for sale – an economic good to be enjoyed through tourism – as indicated by the couple in more modern clothing walking in the background. “Nature” here manifests fisher empowerment and visibility, but it also reifies the commodification of the sea and coastline as a site of tourism, hotels and “modernization” that they resist. It celebrates their connection to nature, but also uses this connection to advertise tourism – many effects of which are opposed by fishers – and highlights their separation from the rest of Keralan society. Paraphrasing the fisher quoted earlier, “nature” here becomes a site through which fishers are both “heroes” and “zero”.

Figure 1: Kerala Tourism Poster (2019)

Source: author

2. Techno-scientific solutions

> *"Everything comes from science." (KSDMA officer).*

> *"We needed to show something scientific. So we took all the ingredients, like tapioca, and cooked in front of the secretariat… We chanted, 'we are fisher folk! We don't use ammonia!'… Everybody was eating in front of the government building." (T Peter, NFF).*

Kerala's fishers and government also shared a storyline of the panacea-like qualities of science and technology. For the government, "science" meant modernity, progress and the future – truths communicated from the external world to government institutions via their grasp of technical and rational methodologies requiring constant work by government scientists. Meteorology and cyclone monitoring was emblematic of this: as one KSDMA interviewee noted, "science does not stop, it is an ongoing process. Improving forecasting by applying new technologies continues that exercise." This vision of science upheld bio-physical risk epistemologies through its neutrality and objectivity, reflected in mathematical procedures that produce risk maps, temperature graphs, meteorological forecasts and geospatial diagrams of historic weather patterns. Early warning systems, large-scale seawater and windbreaks, and improved geo-location systems for the navy to use during search and rescue all became manifestations of this vision of "science" as modernity and progress for the government.

This rendering of science served at least two visions of desirable futures for the government. First it upheld a vision of India's national progress as measured by

technological and scientific achievements. As one interviewee at the ILDM told me, his meteorological work has significant geopolitical implications: “the whole world is watching for cyclones. Like NASA. But India’s cyclone warning system is sometimes better than the USA. Its prediction capacity of Indian cyclones is better… The Indian system is better as it’s able to provide more accurate warnings, probably due to better technology or algorithms.” Here the storyline of technological and scientific advancement indicates India’s supremacy over other nations; and state institutions of risk science such as the IMD and INCOIS become purveyors of national progress.

Second, mastery of science was seen as a source of state authority *within* India, in which the state becomes uniquely capable of translating the natural world into comprehensible and useful information for its citizens. As an employee at the ILDM said, “we use only the latest technologies to find out what nature can tell us.” Science becomes a truth that the government must communicate *to* fishers, and as such a truth that it alone has the power to uncover.

For Kerala’s fishers “science” and “technology” meant something different. In the quote at the beginning of this section, T Peter is passionately describing how in 2018 fishers from Thiruvananthapuram responded to reports that locally caught fish was contaminated with formalin and therefore unsafe to eat. The fishers gathered outside the secretariat with tables and stoves to cook and eat fish bought from market that morning and invited government ministers and passers-by to participate. For the fishers this was “science” – a truth created not by dispassion and objectivity of the scientific method, but by their unique capacity to relate to nature and understand her needs as people of the sea. Science here communicates the truth of nature and the fishers, not the lies of government and businesses. As one interviewee said, “the sea has taught us fishers how to protect her…and the science says that we must protect

Mother Sea from exploitation." Nature's knowledge is validated here through the personal lived experiences of fishers, rather than claims to neutrality; its evidence is intuitive not logical-rational.

As such, this "science" serves the vision of a different life-world, supporting them in their opposition to processes of modernization that threaten their way of life. As one community newsletter writes, "unscientific efforts at 'developing' the [traditional fishing] sectors...appear to have backfired. In the name of greater efficiency and modernization, unsustainable and indiscriminate fishing appear to have come to stay" (fisher community pamphlet). Science here enables fishers to fight for their political and economic rights by connecting their livelihood practices to an ecological agenda for the protection of nature *and* their way of life. Rather than furthering an ideology of the nation's progress, modernization and state authority, science challenges state authority and empowers fishers by representing their intuitive expertise.

This shows that while fishers and the government apparently clash in how they cognitively know cyclone risk, they also share a hidden discourse of the importance of scientific solutions. This overlap serves to reify a bio-physical vision of risk in which meteorological predictions can capture cyclone vulnerability, authorizing the life-worlds in which the government does not interfere in fisher social and political vulnerability. It also diminishes the life-world that fishers seek to articulate through their understanding of "science", as experiential knowledge of the joint vulnerability of fishers and nature to corruption, "progress" and modernization. As such this discourse coalition indicates aspects of fisher epistemic vulnerability: it both reifies unwanted bio-physical visions of cyclone risk, and also indicates ways in which these visions might be challenged.

Conclusion: Liquefying nature for the possibility of alternative life-worlds?

How can we refigure “nature” to make alternative life-worlds possible? This is an increasingly urgent question for many geographers in a world where liveable futures are more and more shaped by expertise about climatic hazards – particularly in poorer communities. This paper has approached this question by examining aspects of fluidity within assemblages of cyclone risk expertise in Kerala, India. Assemblages are increasingly used to conceptualize how relations of knowledge, politics, actors and objects configure around particular meanings and possibilities for living, yet some work in Assemblage Theory (AT) has found conceptualizing flux challenging. By drawing upon the concepts of discourse coalitions and interactional co-production this paper has sought to analyse two aspects of fluidity: concealed, non-cognitive processes of epistemic agency and the dynamic contingency of epistemic authority and contemporary politics. At the same time it has introduced the concept of “epistemic vulnerability” as a form of exposure to harm arising from and constituting an (in)capacity to influence expertise about environmental risk. This analysis has various implications for making alternative life-worlds possible through climate risk expertise (CRE).

First, the concept of epistemic vulnerability contributes to debates in Disaster Risk Reduction (DRR) about how to understand “natural” risk by positing epistemic agency as a kind of vulnerability (alongside existing kinds of political, economic and social vulnerability). While much work in DRR has sought to foreground the socio-economic determinants of vulnerability, there is also a concern in current research that “arguing that disasters are 100 per cent not natural and/or socially constructed…excludes the uncertainty of the material environment and its significant

relationships with the social" (McGowran and Donovan 2021: 1601). The concept of epistemic vulnerability addresses this tension by foregrounding the agency by which the material environment is given meaning by the social world as a source of vulnerability to material harm. Foregrounding how "vibrancy unfolds and is qualified within a meaningful order" (Catherine Fennell quoted in Angell 2014: 668) gives greater significance to the material impacts of hazards without black-boxing them as agents capable of doing harm in their own right.

Second, many geographers have sought to engage with the persistent challenge of epistemic agency – what it is and how it is created (e.g. Peet and Watts 1996; Schlosberg 2012). In AT this has often focused on visible, cognitive epistemic agency: how the knowledges of political opponents clash resulting in impasse or ambivalence, or how powerful actors shape assemblages with their ways of knowing. Conversely, this work has shown how hidden, non-cognitive processes effect epistemic agency in assemblages by examining how apparent epistemic clashes can mask the existence of shared discourses that reify certain epistemologies in hidden and cognitively unwanted ways.

This has implications for how we understand the agency of actors to bring about alternative life-worlds in assemblages. Tacit and unintended discourse coalitions suggest that *speaking* doesn't necessarily lead to voices being *heard* and influencing expertise, not just because these actors might have fewer stand-alone political-economic resources, but because of how they enact hidden discursive alliances in the way they articulate their needs. This suggests a need for caution about expecting local voices to encourage alternatives to existing expertise even when they are put on apparently "equal footing" with official experts in participatory spaces. In Kerala fishers used established and legitimate participatory processes for expressing their socio-

economic needs – through media outlets and culturally sanctioned protests – yet their messages become obscured, lost or complicated by concealed discursive reification of bio-physical risk epistemologies.

Third this work has contributed to understanding how authoritative meanings become attached to nature in dynamic and fluid ways in assemblages by showing how these significances are interactionally co-produced with political orders. Much current work on assemblages has examined how meaning is generated through inscription devices (e.g. Latour 1987; Li 2007) that are the effects of historic political orders, leading them to be rendered fixed and unchanging. In this study meaning becomes ascribed to phenomena such as life-jackets and sirens through contingent and dynamic interaction with political norms and expectations that are themselves provisional and dependent. This indicates more possibility for flux and indefiniteness than current approaches to the encoding processes of inscription devices and the fixed epistemic agency of the material objects they produce.

To conclude, the research presented here shows that deeper understanding of how assemblages of knowing nature are fluid and contingent is crucial to enabling the emergence of alternative life-worlds. It is not enough to illustrate how configurations of knowledge, discourses, actors, political interests and material phenomena are stabilized. Rather more attention needs to be paid to how they evolve and mutate in hidden and entangled ways to indicate interactions and openings through which alternative futures might possibly emerge. The concepts of discourse coalitions, interactional co-production and epistemic vulnerability are just some approaches, but more are needed.

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Conclusion

Towards a more democratic climate expertise?

How can the democratization of climate expertise better represent vulnerable people such as traditional fishers? This is a critical concern. Marginalized people around the world are facing more intense and frequent climatic events (IPCC 2022) together with strategies that frequently fail to address – and at times even exacerbate – their exposure to harm (Schipper 2020; Ribot 2014). Existing responses to this dilemma have tended to adopt one of two approaches. On one hand, many have argued that the problem is a "deficit" of particular forms of information – from scientific "facts" to local and indigenous "knowledge" – and the solution lies in voicing this information more loudly. On the other hand, others have promoted the joint production of knowledge through participatory methods such as consultative co-production to generate expertise that is both "useful" and "usable" (e.g. Lemos et al 2018). The essays presented here have argued for a different approach. Drawing upon insights from science and technology studies – in particular, the concepts of co-production and civic epistemologies – these essays have argued that democratizing climate expertise requires much greater attention to how non-cognitive politics – such as the unconscious effects of politics on subjectivities and narratives – shapes what knowledge gets heard and who is seen to be producing it. This has implications for various debates seeking to make more relevant and useful climate expertise.

1. *The epistemic agency of climate risk knowledge lies in the (often non-cognitive) political structures that make it visible.*

    These essays contribute to debates in CCA and DRR about the persistence of technical solutions to bio-physical risks. Much existing work

addresses this concern by including local actors in knowledge production so that they can express their contextually relevant risk experience (e.g. Lemos et al 2018). Yet this work has shown that epistemic agency doesn't lie in particular knowledges or actors but in the (often non-cognitive) political structures that given them visibility and authority. For example, while Kerala's fishers cognitively articulate risk as a socio-economic phenomenon, non-cognitive discourse coalitions disrupt their epistemic agency by lending authority to the purely bio-physical visions of risk they seek to challenge. This means inclusion should not be seen merely as a process of bringing diverse people and knowledges together (e.g. Armitage et al. 2011), but understanding how non-cognitive politics shapes their capacity to be seen and influential. It also means that rather than predicting the agency and effects of climate knowledge based on its visible content, more attention should be given to what it *means* to people – that is, what political orders it represents and upholds (e.g. Jasanoff 2010).

2. *Participatory outcomes are conditioned by the dynamic and interactional shaping of expertise and contemporary politics.*

This work adds to debates about the challenges of democratizing expertise through participation. Existing critique of participatory methods has focused on how participation channels discursive control (e.g. Cooke and Kothari 2001). Yet this work has shown that the actors, knowledges and methodologies of participation are shaped through more dynamic non-cognitive political interactions (Jasanoff 2004). Here, knowledge does not merely reflect politics, but also constitutes political orders and their exclusionary effects; democracy is not a mute setting for participation or even an agreed upon goal,

rather a contested order that shapes who is selected for participation and for what purpose, whose knowledges are seen, and what successful "consensus" outcomes look like; and participants are not autonomous, pre-defined categories but subjectivities constituted and enacted through specific political contexts (e.g. Chilvers and Kearnes 2019). This approach to participation suggests more possible vectors for intervention than simply looking at how knowledge and subjectivities are agents of hegemonic power.

3. *CEs can be shaped by citizens outside the "civic" in fractured or contested political orders at the sub-national level*.

These essays have contributed to work in Science and Technology Studies (STS) on the co-production of knowledge and political order by examining the concept of civic epistemologies (CEs) in sub-national developing country contexts (Jasanoff 2005; Haines 2019) and developing the concept of *expectations of democracy*. First this has enabled the constitutional relationship between politics and expertise to be examined more deeply by studying arenas of political order that are fractured and in the making (Haines 2019). Second it has highlighted the epistemic agency of citizens not contained within the official "civic", broadening the range of sites at which knowledge orders are created. The concept of epistemic vulnerability (developed in the fourth paper) highlights in particular how the marginalization of certain groups interacts with their agency to influence the knowledge orders that govern their lives in a changing climate.

4. *Academic scholars need to examine and reflect more deeply upon their role in shaping the epistemic processes that they examine.*

Finally the work presented here seeks to encourage deeper consideration of the interaction between scholarly research practices and the democratization of expertise. The growing interest in increasing the relevance of expertise and governance to historically marginalized actors is evident in many current contexts from Fridays for Future, to Black Lives Matter, to debates about facial recognition technology. Much of this work recognizes that expertise and technology does not proliferate from being objectively true or universally useful, but by representing particular socio-political values and reproducing desirable political orders. While much research – such as the essays presented here – has sought to examine how this happens and with what effects, less attention has been given to the role of academic scholarship in these processes. Yet increasing debates about how to "de-colonize" academic programmes and research (e.g. Sultana 2019; Liboiron 2021) highlights the urgency of these questions – particularly amidst debates about climate justice. Key issues here include *how* research is conducted, *who* is included and *for what purposes* (e.g. Smith 1999). Moving forward, conceptual debates in STS about the interactional relationship between knowledge and political orders is crucial for understanding the ways in which scholars are key builders of society's epistemic scaffold; and more energy needs to be spent on reflecting upon the effects of our cognitive and non-cognitive political entanglements.

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Annex 1. Fisher semi-structured interviews, Poonthura

The is one of the survey sheets I used to gather information from fishers in Poonthura, India. Similar surveys were used in Odisha, San Felipe and Puerto Escondido.

Name	Age	Gender
Religion	Dependents	Age left school

1. INTRODUCTORY RISK QUESTIONS

What risks and challenges do you face in your life?	
Do you think these risks can be addressed and managed?	
Who helps you most in your work and life? (e.g. friends, family, government, NGOs, charities, Church, NFF…)	

2. STORMS AND CYCLONES

Do you fear storms? How do they affect you?	
What happens before and during a storm? And what happens after a storm?	
Who provides the most help before and after a storm? What do they do?	
How does the government help you?	
What would make you feel less vulnerable to storms in the future?	
How important are the IMD weather warnings (rate 1-5)?	

Do you always trust the IMD warnings?	
Who or what is to blame for the damage of storms and cyclones?	

3. VULNERABILITY

How supported do you feel by 1) State government (1-5) 2) National government (1-5) 3) Matsyafed (1-5) 4) Fishing Organizations (1-5) 5) Catholic Church (1-5) 6) Friends and family (1-5)	
What would help you the most? 1. New technology eg GPS 2. New equipment eg boats 3. Financial compensation for days you cannot fish 4. Training in an alternative livelihood 5. Better access to education 6. Financial support 7. New home	

4. POLITICAL ORDER

Do you think voting in elections is important? Do you think your vote makes a difference?	
How 'democratic' do you think Kerala and India are? (Rate 1-10) Why?	
What does democracy mean to you?	
Is the government held to account? How?	

Does the government protect people against poverty?	
How equal is Kerala?	

4. CLIMATE CHANGE

Have you noticed any effects of 'global climate change'? Give examples	
How can these challenges be addressed?	

5. FINAL QUESTIONS

How has life for your community in changed in the last 20 years?	
Do you worry about the future?	
Do you want your children to be fishers?	
What does progress look like to you?	

Annex 2. List of Interviewees

This is a list of people I interviewed for this research. It does not include fishers surveyed, or discussions with fishers unconnected to an organization, such as a trade union or cooperative.

Mexico

Affiliation	Place	Date
NGOs		
UNDP[15] Merida	UNDP, Merida	05.11.2018
UNDP Merida	UNDP. Merida	07.11.2018
ODI[16]	Skype	17.10.2018
UNDP Oaxaca	Skype	20.09.2018
UNDP Oaxaca	Skype	29.09.2018
A.C. EECO[17]	A.C. EECO Office, Oaxaca	10.01.2019
Academic Institutions		
Autonomous University of Yucatán	University Campus, Merida	06.11.2018
Autonomous University of Yucatán	University Campus, Merida	06.11.2018
Benito Juárez Autonomous University	Café, Oaxaca	11.01.2019
FLACSO[18]	Skype	25.09.2018
COLMEX[19]	COLMEX, CDMX[20]	01.11.2018
Government		
CONAGUA[21] Yucatán	CONAGUA, Merida	12.11.2018
CONAGUA Yucatán	CONAGUA, Merida	13.11.2018
SEPASY[22] Yucatán	SEPASY Office, Merida	13.11.2018

[15] United Nations Development Programme
[16] Overseas Development Institute
[17] Espacio de Encuentro de las Culturas Originarias (Meeting space for Original Cultures)
[18] Facultad Latinoamericana de Ciencias Sociales (Latin American Faculty of Social Sciences)
[19] The College of Mexico
[20] Mexico City
[21] Comisión Nacional del Agua (National Water Commission)
[22] Secretaría de Pesca y Acuacultura Sostenables (Secretary of Sustainable Fish and Aquaculture)

SEPASY, Puerto Escondido	Offices, Puerto Escondido	04.02.2019
Panabá Municipality	Municipality office, Panabá	04.12.2018
Panabá Municipality	Municipality office, Panabá	04.12.2018
San Felipe Municipality	Municipality office, San Felipe	05.12.2018
San Felipe Municipality	Municipality office, San Felipe	05.12.2018
San Felipe Municipality	Municipality office, San Felipe	05.12.2018
San Felipe Civil Protection	CP, San Felipe	06.12.2018
San Felipe Civil Protection	Shore-front, San Felipe	06.12.2018
San Felipe Civil Protection	CP, San Felipe	10.12.2018
San Felipe Civil Protection	CP, San Felipe	07.12.2018
PRI[23]	Café, San Felipe	10.12.2018
PAN[24]	Café, San Felipe	07.12.2018
PAN	Café, San Felipe	15.11.2018
Port Captain	Captain's office, San Felipe	15.11.2018
ENAPROC[25]	ENAPROC office, CDMX	26.11.2018
CENAPRED[26]	CENAPRED office, CDMX	28.11.2018
CENAPRED	CENAPRED office, CDMX	28.11.2018
SEMARNAT[27]	SEMARNAT office, CDMX	29.11.2018
SEGOB[28]	Café, CDMX	27.11.2018
Civil Protection	Villahermosa	23.11.2018
Civil Protection	Villahermosa	23.11.2018
ENAPROC	ENAPROC, Chiapas	07.02.2019
ENAPROC	ENAPROC, Chiapas	07.02.2019
ENAPROC	ENAPROC, Chiapas	08.02.2019
CONAGUA	CONAGUA, Oaxaca	14.01.2019
CONAGUA	CONAGUA, Oaxaca	14.01.2019
CONAGUA	CONAGUA, Oaxaca	14.01.2019
Civil Protection (state)	CP Office, Oaxaca	15.01.2019
Civil Protection (state)	CP Office, Oaxaca	16.01.2019
Civil Protection (state)	CP Office, Oaxaca	16.01.2019
CONAGUA, Oaxaca	CONAGUA Office, Oaxaca	11.01.2019
Civil Protection (Puerto Escondido)	Café, Puerto Escondido	18.01.2019

[23] Partido Institutional Revolucionario (Institutional Revolutionary Party)
[24] Partido Acción Nacional (National Action Party)
[25] La Escuela Nacional de Protección Civil (National School for Civil Protection)
[26] Centro Nacional De Prevención de Desastres (National Centre for the Prevention of Disasters)
[27] Secretaría de Medio Ambiente y Recursos Naturales (Secretary for Environment and Natural Resources)
[28] Secretaría de Governación (Secretary of the Interior)

Civil Protection (Puerto Escondido)	Café, Puerto Escondido	22.01.2019
Civil Protection (Puerto Escondido)	Café, Puerto Escondido	01.02.2019
Civil Protection (Puerto Escondido)	CP Office, Puerto Escondido	24.01.2019
Civil Protection (Puerto Escondido)	CP Office, Puerto Escondido	24.01.2019
Civil Protection (San Pedro Mixtapek)	CP Office, San Pedro Mixtapek	22.01.2019
Civil Protection (San Pedro Mixtapek)	CP Office, San Pedro Mixtapek	22.01.2019
Civil Protection (Santa Maria Colotepek)	CP Office, (Santa Maria Colotepek)	21.01.2019
Port Captain (federal)	Captain's office, Puerto Escondido	23.01.2019
Port Captain (federal)	Captain's office, Puerto Escondido	23.01.2019
Port Captain (federal)	Captain's office, Puerto Escondido	30.01.2019

Fisher organizations

Miguel Durám Permit Holders	Shore-front, San Felipe	19.11.2018
Emilio Sanchez Permit Holders	Emilio Sanchez office, San Felipe	17.11.2018
"Unido" Cooperative	Unido office, San Felipe	16.11.2018
"Unido" Cooperative	Unido office, San Felipe	16.11.2018
"Legitimos" Cooperative	Legitimos office, San Felipe	15.11.2018
"Legitimos" Cooperative	Shore-front, San Felipe	20.11.2018
"Legitimos" Cooperative	Shore-front, San Felipe	20.11.2018
Blue Cooperative	Café, Puerto Escondido	28.01.2019
Blue Cooperative	Café, Puerto Escondido	29.01.2019

India

Affiliation	Place	Date
NGOs		
CSE[29]	Boston, Mass, USA	20.12.2017
Pondi CAN[30]	Café, Pondicherry, India	13.01.2018
Catholic Church	St Thomas's Church, Veli	12.08.2018
Catholic Church	St Thomas's Church, Veli	12.08.2018
Catholic Church	Beachfront, Poonthura	13.08.2018
Catholic Church	Beachfront, Poonthura	13.08.2018
Catholic Church	Office, Thiruvananthapuram	15.02.2018
Catholic Church	Office, Thiruvananthapuram	16.02.2018
Quillon Social Service Society	Kollam, Kerala	30.07.2018
Self-Employed Womens' Association	Beach, Thiruvananthapuram	17.08.2018
Centre for Global Environmental Research	Skype	17.08.2018
CPR[31]	CPR, Delhi	10.01.2018
TERI[32]	Skype	15.03.2018
UNDP	Café, Thiruvananthapuram	07.05.2019
Kerala People's Science Movement	Café, Thiruvananthapuram	08.05.2019
CPPR	Phone	19.05.2019
SOLAR, Odisha	Beachfront, Puri	11.06.2019
Action Aid, Odisha	Café, Bhubaneshwar	12.06.2019
UNICEF Odisha	Phone	25.05.2019
UNDP Odisha	Offices, Bhubaneshwar	31.05.2019
Catholic Relief Service, Odisha	Café, Bhubaneshwar	22.05.2019
Oxfam Odisha	Offices, Bhubaneshwar	22.05.2019
World Bank	Conference Centre Bhubaneshwar	24.05.2019
Baxipalli Church	Beachfront, New Baxipalli	02.06.2019
Baxipalli Church	Beachfront, New Baxipalli	16.02.2020
Academic Institutions		
Azim Premji University, Bengaluru	Phone	17.12.2019
Centre for Development Studies, Kerala	CDS, Kerala	11.08.2018

[29] Centre for Science and Environment, Delhi
[30] Pondicherry Citizens Action Network
[31] Centre for Policy Research, Delhi
[32] The Energy and Resources Institute

Centre for Development Studies, Kerala	Café, Thiruvananthapuram	10.05.2019
University of Kerala	University Campus	02.08.2018
University of Kerala	University Campus	02.08.2018
University of Kerala	Café, Thiruvananthapuram	12.08.2018
Kerala University of Fisheries and Ocean Studies	Campus, Kochi	20.08.2018
Centre for Ocean Sustainability Research and Education	Beachfront, Thiruvananthapuram	14.05.2019
Utkal University	Café, Bhubaneshwar	31.05.2019
Government		
Department of Science, Tech, and Env.	Café, Pondicherry, India	14.02.2018
National Centre for Earth Science Studies	Café, Thiruvananthapuram	06.08.2018
Fisheries Department	Café, Thiruvananthapuram	08.08.2018
ILDM[33]	ILDM Offices, Thiruvananthapuram	07.08.2018
ILDM	ILDM Offices, Thiruvananthapuram	07.08.2018
ILDM	ILDM Offices, Thiruvananthapuram	07.08.2018
ILDM	ILDM Offices, Thiruvananthapuram	07.08.2018
ILDM	ILDM Offices, Thiruvananthapuram	08.05.2019
ILDM	ILDM Offices, Thiruvananthapuram	08.05.2019
KSDMA[34]	Offices, Thiruvananthapuram	15.07.2018
KSDMA	Café, Thiruvananthapuram	07.05.2019
KSDMA	Café, Thiruvananthapuram	10.05.2019
IMD[35], Kerala	IMD Offices, Kerala	09.05.2019
IMD, Kerala	IMD Offices, Kerala	09.05.2019
IMD, Kerala	IMD Offices, Kerala	09.05.2019
IMD Odisha	Phone	11.05.2019
Matsyafed	Matsyafed Offices, Kerala	19.05.2019
Fisheries Department	Offices, Thiruvananthapuram	17.05.2019
Fisheries Department	Offices, Thiruvananthapuram	18.05.2019
OSDMA[36]	Offices, Bhubaneshwar	25.05.2019
OSDMA	Offices, Bhubaneshwar	25.05.2019
OSDMA	Offices, Bhubaneshwar	31.05.2019

[33] Institute of Land and Disaster Management, Kerala
[34] Kerala State Disaster Management Authority
[35] Indian Meteorological Department
[36] Odisha State Disaster Management Authority

OSDMA	Offices, Bhubaneshwar	08.06.2019
OSDMA	Offices, Bhubaneshwar	12.02.2020
OSDMA	Offices, Bhubaneshwar	14.02.2020
Water Resources Dept, Odisha	Offices, Bhubaneshwar	30.05.2019
District Collector, Puri	Offices, Bhubaneshwar	04.06.2019
District Emergency Office, Puri	Offices, Bhubaneshwar	05.06.2019
IMD Odisha	Offices, Bhubaneshwar	29.05.2019
Joint Relief Commission, Odisha	Offices, Bhubaneshwar	29.05.2019
Orissa Livelihood Mission	Offices, Bhubaneshwar	28.05.2019
ODRP[37], Ganjam District	Offices, Ganjam	01.06.2019
ODRP, Ganjam District	Offices, Ganjam	01.06.2019
Fisheries Department, Odisha	Offices, Bhubaneshwar	11.06.2019
Fisher organizations		
NFF Chennai	Skype	15.01.2018
NFF Kerala	Beachfront, Thiruvananthapuram	30.07.2018
NFF Kerala	Beachfront, Thiruvananthapuram	30.07.2018
NFF Kerala	Home, Veli	18.05.2019
NFF Kerala	Home, Veli	09.05.2019
SIFFS	Office, Thiruvananthapuram	03.08.2018
SIFFS	Office, Thiruvananthapuram	03.08.2018
Kerala Boat Operator's Association	Kollam, Kerala	30.07.2018
Coastal Womens' Forum	Beachfront, Veli, Kerala	05.08.2018
Coastal Womens' Forum	Beachfront, Veli, Kerala	05.08.2018
Veli People's Welfare Organization	Beachfront, Thiruvananthapuram	06.08.2018
Womens' Fishvendors Association	Beachfront, Thiruvananthapuram	10.08.2018
Womens' Fishvendors Association	Beachfront, Thiruvananthapuram	10.08.2018
NFF Odisha	Beachfront, Puri	04.06.2019
NFF Odisha	Restaurant, Puri	05.06.2019
NFF Odisha	Restaurant, Puri	05.06.2019

[37] Odisha Disaster Recovery Project