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Debating the unknowns of marine oil exploration in Mexico

Liina-Maija Quist*, Anja Nygren

Development Studies, University of Helsinki, Finland

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ABSTRACT

Marine extraction accounts for one third of the world's hydrocarbon production. Several analyses suggest that seismic surveys employed in oil exploration harm marine life; however, their long-term impacts have not been extensively studied. We examine debates between fishers, the oil industry, and governmental authorities over the effects of oil explorations in Tabasco, Mexico. The study employs ideas from historical ontology in tracing the contested production of truth-claims about exploration in the context of scientific uncertainty. It shows how actors, through their different engagements with the sea, and with different degrees of power, frame claims about the relations between exploration and fish. We argue that fishers, through their efforts to “think like fish” produce situated knowledges about the effects of oil exploration. They explain a disappearance of fish by their understanding that seismic surveys disturb fish migration, impair the hearing of fish and cause fish death. Oil company and governmental representatives frame the impacts of oil exploration as insignificant by separating environmental and social dimensions, by isolating individual exploration events, and by arguing that possible effects are transitional. Due to scientific indeterminacy, oil exploration is malleable in the hands of powerful political representations that understate its possible impacts on marine socio-environments.

1. Introduction

In recent years, Mexico's partly privatized oil industry has radically expanded oil exploration and oil extraction in the coastal and offshore spaces of the Gulf of Mexico. Small-scale fishers in the coast of Tabasco are highly concerned about the future of fishing given the intensified conflict with the oil industry over sea space (Quist and Nygren, 2015). According to the fishers, “*el pescado migra, y no sabemos si vuelve o no*” (the fish migrate and we don't know if they return), as Julio, one of the small-scale fishers explained. Many fishers connect the disappearance of several fish species with the *explosiones*, a shorthand the fishers use when speaking about the seismic surveys employed to map potential oil deposits. In 2017, the surveys had been going on in the coastal waters of Tabasco almost continuously for over a year. Oil company representatives and governmental authorities, however, claimed the surveys had little or no impact on fish.

Political-economic imperatives to expand oil and mineral extraction into new areas in many parts of Latin America complicate the efforts made by politically marginalized social groups to defend local environments and livelihoods (Arsel et al., 2016; Bebbington and Bury, 2013; Schilling-Vacaflor et al., 2018). Furthermore, technological and environmental uncertainties connected with intensified resource extraction make it difficult for environmental justice movements and

human rights advocates to demonstrate evidence of harm (Haarstad, 2009; Sawye, 2017). Monitoring the environmental consequences of marine oil extraction is especially difficult due to the challenging biophysical conditions and the technical capacities and economic investments required (Appel, 2012). In public and scientific debates, attention to the impacts of oil extraction is focused on easily observable, catastrophic events such as oil spills and explosions, while possible effects of oil exploration have received scant attention, despite the fact that exploration is an issue causing increasing tension in many parts of the world (ABC, 2018; Arbo and Thanh Thuy, 2016). In Mexico, the socio-material complexity of determining the harmfulness of oil extraction, the political-economic imperative to expand the hydrocarbon production, and the political legacy of oil as *the* symbol of patrimony, complicate the efforts to carefully examine the effects of oil industry on local environments and communities (Quist, 2018; Salas Landa, 2016).

The potential for oil exploration to affect marine life has been acknowledged in several studies since the 1990s (SCU, 2012). Seismic surveys involve noise-producing shocks of pressurized air being shot from vessels to the seabed to track potential hydrocarbon deposits (Hawkins et al., 2015). The noise of seismic surveys is the second highest contributor to human-caused underwater noise in total energy output per year, after nuclear and other explosions. Noise from a single seismic survey can penetrate hundreds of kilometers into the seafloor

* Corresponding author.

E-mail address: liina-maija.quist@helsinki.fi (L.-M. Quist).

and blanket an area of over 300,000 km², raising background noise levels 100-fold (20 dB) for weeks or months (Weilgart, 2013).

For many marine animals, sound is their most vital sense, used for orientation, preying, and reproduction. Many studies have shown that exploration disrupts the communication of marine mammals and fish, may impair their hearing, increase fish and larval mortality, destroy coral reefs, and result in fish displacement (Paxton et al., 2017; Williams et al., 2015). However, most studies stress that there are significant gaps in knowledge and that more detailed studies are needed to address species-specific effects and cumulative consequences at population and ecosystem levels (Haver et al., 2017).

In this article, we analyze the debates between sea fishers, representatives of the oil industry, and closely associated governmental authorities over the contested consequences of seismic surveys employed in the search for oil deposits in the coastal and offshore areas of Tabasco, southeastern Mexico. Our analysis focuses on how these actors make claims about the consequences of exploration in the context of scientific uncertainty. We pay special attention to how their efforts to understand and disclose the potential effects of oil exploration diverge, and to their differentiated opportunities to get their voices taken into account in political forums. The examined truth-claims are at the core of broader conflicts between fishers and oil companies over sea space.

The next section presents recent theorizations within discussions of historical ontology, and their relevance when analysing contested truth claims about the environmental-social consequences of oil extraction; it is followed by a section explaining the context and methods of the study. The fourth section analyzes the fishers' efforts to understand and disclose possible links between oil exploration and fish disappearance through their situated knowledges, while the fifth examines the truth-claims of the oil industry and governmental authorities, which question the unknowns around exploration and demand evidence of the claimed harm. The article concludes by summarizing competing truth-claims related to the environmental-social consequences of oil extraction and the differentiated opportunities to have them taken into account.

2. Historical ontology and environmental-social uncertainties

The recent expansion of global extractive operations into new areas has provoked intense discussion about the unforeseen environmental-social risks involved in resource extraction. In Latin America, governments across the political spectrum have embraced the expansion of oil, natural-gas and mineral extraction into previously unexplored terrains (Arsel et al., 2016; Valdivia, 2015). According to Bebbington and Bury (2013: 270), the emerging conflicts between the extractive industries and local communities revolve especially around the contested meanings and consequences of the environmental-social uncertainties involved.

In this study, to understand the debates around the effects of oil exploration in coastal Tabasco, we draw on Ian Hacking's (2002: 23) ideas of historical ontology concerning the interactions between "what there is (and what comes into being) and our conceptions of it". According to Hacking, social and institutional practices of naming and describing are an important part of how different phenomena come to emerge and exist in human perception. Drawing on these ideas, we are interested in tracing which issues are made meaningful and which are downplayed as different actors with diverging interests in the sea make claims about the consequences of oil exploration. In the indeterminacy of multifaceted interpretations, what becomes interesting is not only how actors make efforts to validate "truths", but how, through their different views and interests, they give value to certain claims while understating others. While public debates about oil extraction focus on ways to prevent catastrophic events, analyses of how differently positioned actors make sense of barely visible but potentially relevant indeterminacies demonstrate the pertinence of situated knowledges in conceptualizing environmental-social uncertainties and how to manage them.

Closely related to Hacking's ideas of historical ontology is Bachelard's (1970[1931–32]) Bachelard, 1970 Bachelard's (1970[1931–32]) concept of the phenomenotechnique, which provides an analytic to examine how materially and politically shaped, situated knowledges enter into debates around uncertain consequences of oil exploration. Like historical ontology, the notion of phenomenotechnique suggests that new phenomena are not simply "found out there". However, while historical ontology focuses more on the social practice of naming, Bachelard highlights how phenomena come into being or fade from existence through thinking and cognate devices, such as theoretical approaches and laboratory instruments employed to understand these phenomena (Rheinberger, 2005). In this study, we take the concept of phenomenotechnique to signify that the harm that underwater noise may cause marine life is recognized or disregarded through competing ways of knowing, and respective means of conceptualizing, techniques of verifying, and forms of experiencing, all of which are politically and economically mediated (Petryna, 2017). The notion of phenomenotechnique helps illustrate contested knowledges of oil exploration and the politics surrounding their divergent valuation.

For many indigenous, *campesino* (peasant) and fisher communities in Latin America, the unknowns related to new technologies and intensified forms of oil, natural-gas, and mineral extraction entail a continuation in their social history of coping with, and struggling against, the injustices associated with extensive resource extraction and resource grabbing. Auyero and Swistun (2009) have shown in their study of informal settlements located near the contaminating oil refineries in Buenos Aires, Argentina, that statements about oil not being harmful to human bodies are made to matter in public policy, media, and everyday life in ways that obstruct efforts by people living with oil to make claims for environmental justice. Local residents get confused about the connections between oil contamination and their own experiences of "toxicity" when the latter are minimized and rendered invalid by governmental authorities, policymakers, representatives of oil companies, and journalists.

Correspondingly, by employing a Hacking-inspired historical-ontological lens, Sawye (2017), whose work has been particularly informative to our analysis, provides an analysis of how different laws and studies were selectively used in a lawsuit against the Chevron Corporation over its long-term oil operations in indigenous territories in the Ecuadorian Amazonia. She furthermore demonstrates that, in this conflict, the presence of crude oil and its by-products was not in question, rather, it was the harmfulness of these substances to the environment and human health that was disputed. Through a careful analysis of how the reports produced by the plaintiffs' and defendant's technical experts either materialized or dematerialized oil's toxicity, Sawye (2017: 5) shows how complex connections among the production of scientific knowledge, the material complexity of hydrocarbon compounds, and legal reasoning, allowed for making matters of (non-) concern into matters of fact when determining oil's harmfulness.

Drawing on recent scholarship on risk perceptions and toxic encounters, Salas Landa (2016) examines how everyday corporate politics and practices, toxic mundane encounters and affective attachments tend to obscure the harmful presence of the decaying oil industry in everyday life in Poza Rica, Veracruz, Mexico. Salas Landa points out how catastrophic effects of oil production are not just "contained events", but long-lasting processes, where harmful effects endure and accumulate, and during which different actors reproduce, negotiate, and try to explain away the risk of danger. The representatives of the oil industry try to render the hazards of the failing oil infrastructure invisible, while local residents, in order to manage the anxiety and make the everyday life bearable, produce collective explanations to distance themselves from the material and sensuous circumstances of the risk in their living environment. However, as Salas Landa eloquently illustrates, the penetration of the risks involved in the decaying oil infrastructure into local people's lives is so omnipresent that the acts of diminishing the toxic hazards are infused with deep feelings of insecurity

and suffering.

Inspired by these studies, in the following analysis we examine how fishers in the coastal areas of Tabasco make sense of, and claims about, the effects of marine exploration, while seeking to cope with related hazards to their livelihood. Due to the fact that the consequences of seismic surveys are even less understood than the toxic effects of hydrocarbons, our attention is on the situated knowledges and differentiated power positions (Nygren, 1999; Zeiderman, 2012) that mediate the interpretations of uncertainty, and thus, how certain uncertainties *become* matters of concern. Hence, we explore how fishers, oil companies, and governmental authorities make sense of uncertainties through their particular views of, and interests in, the sea, in circumstances that provide constricted avenues for political activism. Considering that the consequences of oil exploration include various unknowns, what becomes interesting is which issues receive attention and which issues are ignored in the discussions among the actors involved.

Efforts by the oil industry and government officials to manage hazards involved in oil exploration contain processes that are materially and politically challenging. Monitoring effects of oil industry on local environments and livelihoods both offshore and onshore depends on technological capacities and economic assets shaped by political-economic interests and geopolitical agendas (Arroyo and Zalik, 2016; Watts, 2017). Partly for this reason, the consequences of oil exploration to fish and other marine life, and to millions of people whose lives and livelihoods depend on them, are largely unknown and highly controversial. This is so despite the fact that thirty per cent of global hydrocarbon extraction takes place in offshore areas; a figure that is expanding due to new infrastructures and technologies developed for extraction in marine waters (Maribus, 2014).

Fishers, oil companies, and governmental authorities employ different conceptualizations and sensory “tools” in their efforts to understand the consequences of marine oil extraction. These differences, and the diverging material relations with, and economic and political interests in the sea by fishers, the oil industry, and governmental authorities, constitute these actors as unequally positioned “knowers”. Understanding the phenomenotechniques employed by fishers to make sense of oil exploration’s uncertain consequences demands attention to fishers’ everyday engagements with the sea (Quist, 2018), to technical skills and situated knowledges acquired through fishing, and to fishers’ ways of exploring the behavior of different fish species. These situated knowledges are (re)formulated amidst politically mediated opportunities to get access to certain resource spaces, as well as by socially differentiated possibilities to get one’s claims taken into account in different policy forums (Nygren, 2018; Nygren and Wayessa, 2018).

The oil companies often base their claims of seismic surveys’ minimal impacts on industry-produced monitoring reports, evaluations produced for industries, and industry-related studies. As efforts to prevent environmental harm are carried out primarily after there is scientific evidence of a serious risk to human lives, less visible phenomena – such as underwater noise that may affect specific nonhuman beings and ecosystems (Hawkins et al., 2015), and thereby the humans that depend on them – accrue less political weight. As we show in the following analysis, prevalent ways of truth-making related to the consequences of oil exploration, and the ways that they evaluate the “sustainability” of oil extraction, enable the oil industry and government authorities to understate the potential harm of exploration.

3. Engaging with different knowledges and claims in Tabasco

Our analysis is based on intensive field research in Tabasco. The first author carried out four and a half months of ethnographic fieldwork within coastal fisher communities and two months of research among oil industrial and governmental actors in Tabasco’s capital, Villahermosa, in 2011–2012 and 2017. During this time, she first lived with the family of a political leader of the sea fishers, and then with that

of an unlicensed fisher. The fieldwork involved participation in, and observation of, fishing activities among three fisher families and several groups of unlicensed fishers in the Grijalva river delta, along the coastline and up to ten kilometers offshore in the course of thirteen fishing trips. The fisher families inhabited three different, but closely connected communities by Tabasco’s coast, and following their lives enabled multiple understandings of the embodied experience of living with fish and oil. Participation in the fishers’ lives provided insights into their daily fishing, their ways of engaging with the sea, and their social and political networks. The fieldwork also consisted of participation in meetings connected with fishers’ political engagements and oil companies’ community development activities. This part of the study included twenty ethnographic interviews and approximately forty informal conversations. Fieldwork also involved ten interviews with oil industry and government representatives and four interviews with environmental-social movements in Tabasco.

The second author carried out forty-two interviews with representatives of the oil industry, authorities at different levels of governmental institutes, and representatives of non-governmental organizations and environmental-social movements in Tabasco between 2011 and 2016. Actively engaged with regulation, evaluation, and public debate concerning environmental-social effects of oil extraction, these actors provided important insights into the multiplicity of perspectives related to the consequences of oil extraction in Tabasco. The second author also participated in various meetings, policy workshops and group discussions with representatives of the oil industry, government institutes, and local residents, including two workshops organized for global oil companies in Mexico, the first entitled “Conflict management in the oil production areas” and the second, “Corporate responsibility in the oil industry.” Participation in these forums offered valuable information about the different actors’ views of oil governance, corporate responsibility, and social license to operate.

Both authors also carried out analysis of the relevant policy documents, development plans, and evaluation reports concerning the oil industry and fishing, as well as reports on seismic surveys, environmental impact assessments, and corporate responsibility reports related to oil industry. Access to the complex networks of Mexican fish-and-oil politics required time and flexibility in field research. The sensitivity of the research topic, and the politically tense relations between the oil industry, government authorities, and different kinds of fishers, required considerable negotiation to build trust and protect the informants’ anonymity.

Tabasco’s coastal areas are home to rivers, lagoons and a river delta which, together with the vast offshore area, provide the environment for a wide range of marine produce, including open sea fish, shrimps, oysters, and crabs. Between the delta and the 200-kilometer offshore limit, groups of three to five sea fishers, using nets and long lines, work from open fiber-glass motor boats to catch gafftopsail catfish (*bandera*), king mackerel (*sierra*), snapper (*guachinango*, *pargo*), snook (*robalo*), and wahoo (*peto*) Federal statistics indicate a 22 per cent decrease in catches of the most important fish species between 2004 and 2013; however, these figures are suggestive, as they exclude catches by unlicensed fishers (CONAPESCA 2013). Correspondingly, although the number of unlicensed fishers has increased as *campesinos* have turned to fishing for subsistence, the total number of fishers has fallen from 10,000 in 2004, to roughly 7,000–8,000 fishers in 2014 (INEGI, 2014; Muñoz Sánchez and Cruz Burguete, 2013). This decrease has taken place since the federal Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food (SAGARPA) stopped issuing fishing licenses to new fishers in the early 1990s, an initiative justified by an official discourse of preventing overfishing. Despite the decrease of fisher numbers, most families in coastal villages and towns depend on fishing for income.

The residents engaged in fishing are heterogeneous in terms of their socioeconomic status and political position. Of the 7,000–8,000 active fishers, half are unlicensed (*pescadores libres*) while the rest are cooperative fishers or license-holding entrepreneurs (*permisionarios*), who

do not usually fish themselves. In addition, many people move between fishing and farming depending on the time of year. The proletarianization of the fishers, the competition over resource space with the oil industry, and the large number of unlicensed fishers who have limited official rights, fragment the fishers' political agenda.

Petróleos Mexicanos (PEMEX), the tenth largest oil company in the world and the fourth largest exporter of crude oil to the US (US-EIA, 2017), has had an active presence in the coastal communities since it initiated oil extraction activities near Tabasco's coast in the early 1970s and offshore in 1977–1980 (Beltrán, 1988; Breglia, 2013). The giant Campeche Sound complex in the Gulf of Mexico accounts for 53 per cent of Mexico's oil production. However, because production in the Sound is decreasing, seismic surveys to search for new deposits have intensified in Tabasco's waters since the early 2000s. Furthermore, in 2003, the government imposed security restrictions banning all but oil industry operatives near oil installations in the Gulf of Mexico in a 15,907 km² marine zone of exclusion, established under federal legislation Acuerdo Secretarial No. 117 (Diario Oficial, 2003). The justification offered for this rule was that it contributed to security enhancement and the prevention of terrorist attacks; however, one of its main aims seems to have been to avoid offshore confrontations, thus ensuring undisturbed oil production (Quist and Nygren, 2015). In 2014, the Mexican government opened the para-estatal oil company, Pemex, partly to private investment as a result of energy law reform (Diario Oficial, 2014a,b).

The wide-scale impacts of oil extraction have been sensed by the coastal communities especially since the enormous blowout of the offshore well Ixtoc in 1979, the world's third largest oil spill, which dumped more than 3.4 million barrels of crude into the Gulf (Soto et al., 2014). Nonetheless, in addition to some other, more recent accidents, such as the blowout of the Usumacinta oil well in 2007, it is the accumulation of small-scale hazards that characterize local experiences of living with oil. According to fishers, oil exploration produces barely visible, but highly disturbing everyday constraints on the fishers' mobility in areas under exploration, and reduce fish catches due to fish migration and death.

Recent expansion of oil extraction in the Gulf of Mexico has increased the oil industry's influence on the livelihoods and living conditions of the fishing communities. Currently, there are 393 oil platforms in the coastal waters of Tabasco and more than 1700 platforms in total in the Gulf of Mexico (Second author's calculations from the federal and state governments' databases) (Map 1). The public narrative of oil as the symbol of national pride and the country's dependency on oil as a global commodity have constrained efforts by residents living or moving around oil production sites to challenge the industry and claim for fairer distribution of the offshore as a resource space (Breglia, 2013; Quist and Rinne, 2017). Furthermore, the legacy of the corporatist politics entangles the oil industry and the state together, with multifaceted webs of political favouritism (Breglia, 2013; Quist, 2016; Zalik, 2009), Federal and state-level politicians, high-level union bosses and local political leaders often funnel the oil rents through systems of patronage. Many of the fisher leaders have age-old networks with politicians of different political parties and government officials affiliated with these parties.

Up to date there exist few internationally-agreed regulations for seismic surveys, and most of the existing requirements accept generalized statements of the possible effects in environmental impact assessments (Prideaux and Prideaux, 2015). Furthermore, most studies of the consequences of exploration focus on cetaceans, while effects on fish species and crustaceans are less well known. In the following analysis of how fishers, oil industry, and government authorities interpret the effects of oil exploration in Mexico, we seek to provide insights into how divergent truth-claims and the involved power relations and forms of authority affect whose explanations account when interpreting the possible environmental-social consequences of oil extraction.

4. Fishers following the disappearing fish

Sea fishers are used to shaping their lives according to uncertainties about weather, available fishing gear, and shifting catches; for Tabascan fishers, oil extraction also figures significantly in their lives, among other uncertainties. In addition to oil spills of varying scales, fishers have to adapt to the everyday risks in their lives and livelihoods to which the oil industry exposes them, including the sharing of their fishing space with oil platforms, uncovered underwater oil tubes, and industry vessels' movements between the platforms and the ports. Fishers' embodied situatedness in the marine space shaped by the complex interrelations between oil and fish constitutes the phenomenotecnique they draw on to interpret uncertainty. As attempts to fully control potentially interrelated phenomena at sea are often futile, for fishers it is important to stay open to multiple explanations of the risks and to know how to react to ongoing changes. The fishers emphasized how the oil industry's activities were driving down fish stocks, expressing concern of how to secure sufficient hauls amidst the rapid change. For fisherfolk, everything in the marine environment is potentially interconnected and unstable, unless otherwise proven.

During the seismic surveys in Tabasco's coastal waters in 2011–2012, the navy closed the area under exploration from all traffic, including fishing, making it impossible for fishers to keep the surveys under close observation. As a result, the fisherfolk had to infer connections between the surveys and decreasing fish species at particular fishing sites. According to them, the oil industry is the major cause of disappearing fish stocks, although many recognize that overfishing and the transformations in sea currents due to changing climatological conditions also affect the fish.

To adjust to alterations in fish movements, fishers with enough resources have begun to follow the fish by moving longer distances. This requires relatively substantial economic assets – a big fishing boat, a major team of fishers and a GPS – which many small-scale fishers cannot afford, as well as constant communication with distant peers to spot areas of abundance. In 2017, during the first author's complementary fieldwork in the village, called here La Estrella, Javier, a visitor from another coastal community at a 150-km distance, arrived with a dozen other people, all in the pursuit of following migrating fish. Javier told about the adjustments that fish movement was demanding of the fishers:

This [fish] migration is new. We need to travel to investigate where the fish are. There are one hundred boats here from Sánchez Magallanes. One boat goes to San Pedro, the other to Paraíso, others fifteen miles east and that's how they divide up. People have begun to communicate when they go together. The one who brings the most [fish] is followed by others.

(First author's fieldnotes, 2017)

Fishers claimed that the undersea noise of pressurized air expelled in seismic surveys had killed some fish species and driven others away from their habitats. As the following quotes by fishers indicate, many argued that the impact of oil exploration on fish and larvae depends on the distance of the fish from exploration operations, the depths at which different species move, and their seasonal migration patterns:

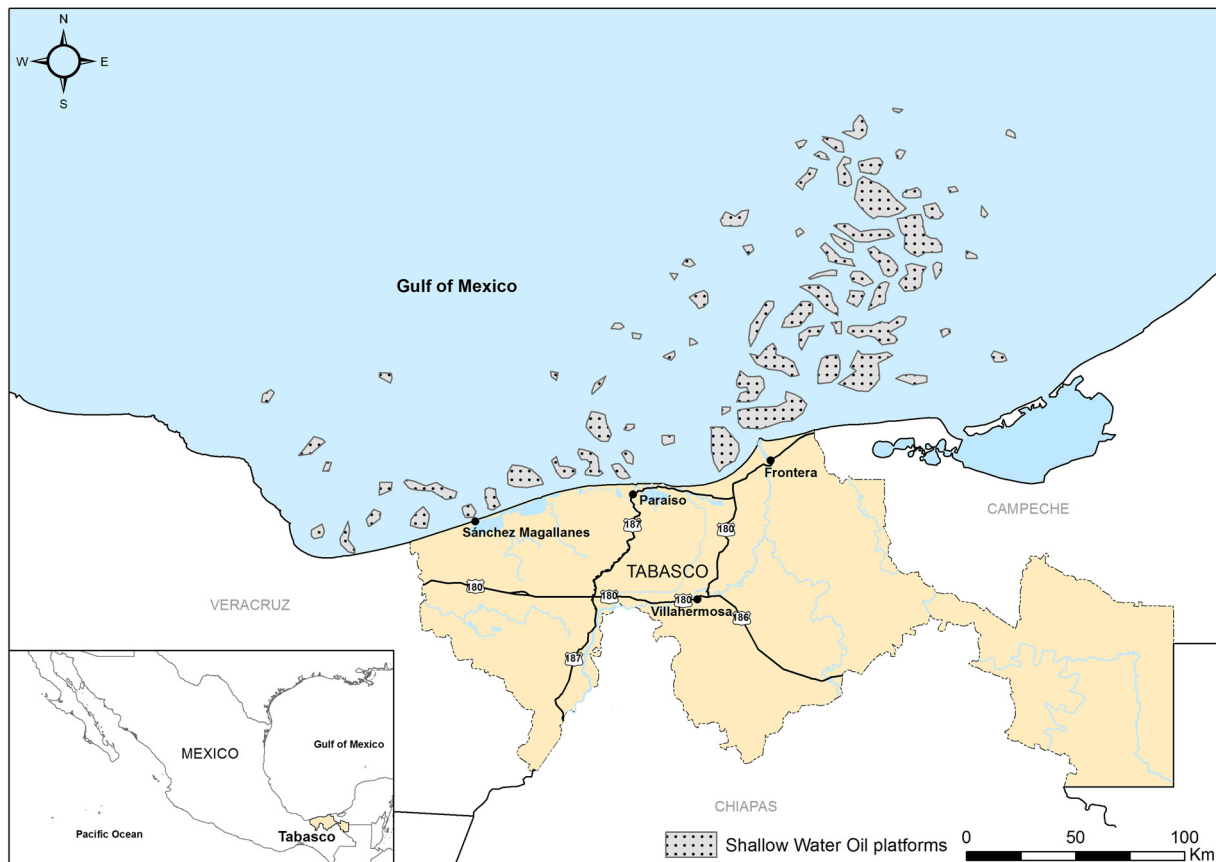
King mackerel is mobile...this year there were no hauls. They are scared away and flee to the open sea. Snapper and barracuda get killed. Other fish further away get disoriented. They [seismic surveys] also destroy coral reefs and reefs that we have built [to attract fish].

(First author's fieldnotes, 2017)

They go dynamiting and if there is fish larvae, it gets killed.

(First, author's fieldnotes, 2017)

Some fishers were of the impression that seismic surveys have especially detrimental consequences to species that swim near the surface or mid-depth, whereas species closer to the seabed may have



Map 1. Shallow water oil platforms in the coastal areas of Tabasco, Mexico.

more time to flee from the shots of compressed air. However, recent studies on bioacoustics and marine biology suggest that the sound and vibration of seismic surveys through the seabed may also impact benthic fish, that is, those living near the bottom (Hawkins et al., 2015: 57)

Unlike ten years ago, when fishers emphasized the reduction in hauls, they now talk about fish disappearance. It seems to many fishers that the fish have gone for good, or that it will take months or years for them to return after exploration. According to fishers, some species, such as cutlass fish, have completely disappeared in the past three years, information that many government authorities and fishery scientists confirmed during fieldwork in 2017. Carlos, a 50-year-old unlicensed fisher, told about the disappearance of fish due to seismic surveys as a serious uncertainty with considerable effects on his livelihood as someone living in and from the marine environment:

The towing [recording cables towed behind seismic survey boats] and radiography [shorthand for the seismic airgun shots] have impacted us, not only environmentally but also through the effects on fish production. They have displaced us. We do not find the fish species anymore. The oil industry boats also intimidate us. They do not let us approach them.

(First author's interview with an open-sea fisher, 2017)

When explaining their views, fishers highlighted that, as fishers, that they know intimately the different fish species' habits and movements and thus how the fish "think". They also emphasized that they understand how different fish species behave and react to disturbances. This ability reminds of what Bear and Eden (2011: 336) describe in their analysis of British anglers as "thinking like a fish". According to Bear and Eden (2011: 341), in order to catch fish, anglers practice "watercraft": adjusting to fish rhythms and trying to make sense of fish experience over space and time. The Tabascan fishers further pointed

out that to survive in an unpredictable marine environment and to know if there are any fish in a stretch of sea, they also need to understand what is below the surface. Alvaro, a fisher leader who had lived by the coast all his life explained that the sharks that used to swim to the river's mouth are highly sensitive to noise, and have thus been scared away forever by noise produced by increased maritime activity, especially by the oil industry.

During the fieldwork, the first author spent considerable fishing time with cooperative fishers Mario and Ana, husband and wife in their 30s, who fished twosome near the river's mouth. Mario's father was also a fisher, and Mario had seen the fish abundance of his childhood turn to alarming unreliability in tandem with the expanding oil industry. For Mario, increased coastal oil explorations were the latest stage of a long history of decreasing catches. He emphasized his species-specific understanding of relationships between seismic surveys and fish disappearance as follows:

The shark is intelligent. The king mackerel is intelligent. They take longer than just two or three months to return.

(First author's fieldnotes, 2017)

Based on their long-term affective experiences in fishing, for fishers the sea is little known and ever-changing, and so is the oil industry and its impacts on marine life and local livelihoods. In trying to express this overwhelming experience, Daniel, an experienced sea fisher explained:

Pemex, in searching for and discovering oil, destroys the fisher in a way that no-one can see but that can be felt.

(First author's fieldnotes, 2017)

Besides a fisher, Daniel was also the municipal delegate, who through his political position, was aware of the political strategies of the oil industry, and the restricted political space local residents had for defending their right to environment. His comment therefore also

reflected the historical ontology of oil exploration in Mexico - in other words – the historically and politically determined truths about it and the fishers' political-economic marginalization by the oil extraction. For Daniel, “destruction” meant both the loss of the lived environment and of the fishers' livelihood.

Overall, although the Tabascan fishers varied in their perceptions of whether the fish would return after the acoustic shots and, if so, how long it would take, they shared a common understanding that oil exploration is one of the most important factors in the disappearance of fish, and that it has different consequences for different fish species. The fishers made sense of the unknowns of seismic surveys based on their situated knowledges, gained by observing changing weather conditions and water currents and through their mobility between different parts of the sea. The fishers' phenomenotechniques for understanding why fish disappear in areas where oil is explored were modified through their intimate engagement with the sea, their experiences of seismic surveys in the Gulf, and their disputes over resource space with the oil industry. The attempts of these fishers to explain the unknowns were closely linked with their efforts to get their resource rights recognized in the conflicts over resource space with the oil industry, even if the avenues for defending their claims were strongly constrained by political processes and hierarchical power relations, that determine the “truths” that count in the public about oil exploration and the oil industry more broadly.

5. Oil industry claiming for evidence

Contrary to fishers, in the oil industry's phenomenotechniques, the marine environment was conceptualized through multiple analytical separations. In the interviews with oil industry representatives, as well as in the environmental reports that evaluated the effects of particular oil exploration projects in Tabasco, the oil industry sought to minimize the complexity of exploration by addressing potential consequences through several analytical distinctions. First, the oil company representatives either denied that seismic surveys had harmful effects on marine life or presented the environmental dimensions of the consequences as discrete from social impacts. Second, they isolated individual exploration events temporally from each other, and third, in the case of any negative impacts, they were claimed to be transitional. These kind of truth-makings became clear in the comments by the oil industry representatives, responsible for oil explorations:

Our oil exploration activities are temporary, transient, not permanent, in any given area. The impact that the oil exploration may have is just temporary. Pemex has a strong commitment to sustainability ... We carefully fulfill all the norms and requirements related to environmental care.

(Second author's interview with oil industry representative, 2011)

In the second author's meetings with the high-level oil industry representatives and governmental authorities in 2011, both groups expressed concerns of the possible conflicts with the sea fishers over the resource space and over the increased disturbance to the marine life, when the oil exploration and oil extraction will increase in the shallow waters of the Gulf of Mexico in the forthcoming years. When analyzing these discussions through a lens of historical ontology, the oil-industrial and governmental representatives used the collectively memorized legitimizations to justify the oil industry's expansive operations. These legitimizations were based on powerful metaphors of oil deposits as national riches, whose utilization is fundamental for the overall development of the country. In this way, the oil industry's truth-makings were tied to strategies of state-making and the consolidation of the state power, characteristic of entangled relationships with the state and the para-statal oil company since the Mexican oil resources were nationalized in 1938 (Beltrán, 1988). In the meetings with local fishers and fisher leaders organized in the same occasion, the fisher leaders drew on the decade-long, highly politicized claims of economic

compensations, while the fishers pointed out that the possible harms caused by the oil extraction for fishers' living environments and livelihoods might be so fundamental that they are difficult to compensate through economic payments.

The truth-claims by the oil industry of the oil exploration's minimal impacts were to a certain degree enabled by scientific indeterminacy concerning the consequences of seismic surveys. Hence, the representatives of the industry argued that the fishers' claims about the disturbances were motivated by an interest in gaining compensations from the oil industry, rather than based on facts. However, while scientists usually follow precautionary principles in the case of uncertainty, oil industry representatives affirmed that unless scientists demonstrated otherwise, using evidence-based facts, there is no reason to suspect that oil exploration harms marine life. Thus, drawing on the Bachelardian and Hacking-oriented ideas, in contrast to scientists, who question the taken-for-granted assumptions when searching for little known connections worthy of attention, the oil industry spokespersons emphasized the oil operations' “clearly recognized and pursued rationale” and then imposed it as a “universal truth” (Rheinberger, 2005: 323). Hence, instead of supporting scientific search for explanations beyond the taken-for-granted, oil industry representatives relied on first-party evaluations and industrial-oriented monitorings that rarely questioned the oil-industry's truth-makings. Many of these studies had been sponsored by the oil industry, and the oil companies also lobbied for organizations and personnel whom they knew well to carry out the required evaluations. The following comment by a state official, responsible for environmental impact assessments of oil extraction, illustrates the kind of truth-claims enabled by the loose framework of environmental regulations and the networks of political favoritism between the state and the oil industry:

In the oil sector, the law is very lax. The evaluations almost always fulfill the requirements set by the law. However, it is one thing to deliver the report, and another thing what the report says. The economic and political power is huge ... there are many economic pressures beyond. The authorities do not have sufficient means. There is a lack of profoundness in the requirements.

(Second author's interview with a state official, 2013)

Current legislation in Mexico does not require environmental impact assessments from seismic surveys, although it requires them for oil extraction and the drilling of exploratory oil wells. Furthermore, the poor implementation of environmental laws favors the oil industry's narratives about the minimal consequences of oil exploration, while mediating which kind of knowledge gains legitimacy in official arenas of political representation. While Salas Landa (2016) demonstrates how local monitoring of the oil industry's impacts on onshore settings is highly challenging, the technological and political difficulties of monitoring marine environments makes civic evaluation and political activism related to marine oil exploration even more difficult (Appel, 2012).

The claims of minimum impacts by seismic surveys, characteristic of oil industry-related evaluations are also based on conceptual separations between impacts on humans and nonhumans, and on species of high and low publicity value. They furthermore draw upon temporal isolations that separate different survey events. Corresponding separations are characteristic of industry-related disaster analyses, which evaluate oil-related disasters as exceptional accidents, and oil exploration and oil extraction as distinct operations, instead of conceptualizing them as inherent elements of the long-term process of hydrocarbon production that might have cumulative and overlapping effects.

Furthermore, in the interviews with oil industry representatives and in the environmental impact assessments for the drilling of exploratory wells in Tabasco's waters, the potential consequences of noise-producing operations were presented as temporary (“*puntual*”), occurring in a relatively limited area, and causing potential harm only to marine

mammals and tortoises (ENI México, 2016; Lamont-Doherty Earth Observatory et al., 2004). Precautionary measures included the visual and acoustic monitoring of the sea, and if mammals or tortoises were detected in the vicinity, the operators were said to give them enough time to flee (ENI México, 2016). The assessments made no reference to marine life more broadly, or to the fact that exploration may be carried out for months or years in the same area. While for fishers, the causalities between seismic surveys and fish disappearance were evident although little known, for oil-industrial representatives and regulating governmental authorities, harmful causalities were not likely unless otherwise proved.

When politically expedient, oil industry representatives emphasized their synergic relationships with the fishers, and the oil companies' commitment to learn from the fishers' traditional knowledge. This claiming became clear in a comment by the spokesperson of a private geophysical company in charge of seismic surveys along Tabasco's coastline in 2011–2012. The company used only on-deck visual monitoring to track the impacts of airguns on fish; to support this practice, the company representative emphasized that even according to fishers, the fish do not flee from seismic surveys:

About the issue of scaring fish away: we even had a fisher go with us on a boat ahead of the gunboat, and what we saw was that the fish were not escaping.

(First author's interview, 2012)

What is interesting in this comment is the company representative's emphasis on the presence of a local fisher in the evaluation team. With this statement, he legitimized the oil industry's claims that seismic surveys do not cause fish disappearance, although detection of fish movement by onboard visual monitoring is as impossible for fishers as it is for anyone else. Through this tactic, the company included fishers and their "watercraft" experience as part of the monitoring, hence disqualifying the fishers' opportunities to question the results.

Another interesting issue in the phenomenotechniques of oil industry representatives is that the marine environment that comes into view through their conceptualizations is a space separate from human beings. The offshore is considered as a distinct area of oil operations, removed from the local environmental and political entanglements, and from multifaceted interconnections between the social and the environmental (Appel, 2012). Such conceptions became evident in the second author's interviews with high-level oil-industry representatives and with government authorities responsible for regulating the extractive operations:

For oil extraction in marine environments, no social impact assessments are required, as there are no people in the sea.

(Second author's interview with oil industry representative, 2014)

Environmental impact assessments are not carried out in the sea ... This is because Pemex has not requested them [laughing] ... Or let's say, because there are no people in the sea. On the coast there are some fishers, but not that many.

(Second author's interview with a state official, 2013)

Hence, while for fishers, separations between the environmental and the social were untenable – for them, the sea cannot be examined as discrete from human beings and human-nonhuman interactions – for oil-industrial representatives and associated governmental authorities, the offshore was a space free from social obligations. Whereas the oil companies needed to legitimize their onshore activities to local communities by representing themselves as socially responsible extractors, the sea was considered as a space empty of humans, where no social license to operate was required. In this respect, what remains unexplained are not only the highly controversial impacts of oil exploration on marine life but also the possible effects of extraction on social vulnerabilization and territorial displacement in offshore environments. By emphasizing that the seismic surveys and marine drillings are carried out in spatially isolated areas, the oil companies underestimated

the significance of the sea as the fishers' lived environment and a vital source of livelihoods.

In general, along with strong affirmations of the overall pertinence of oil operations, the truth-claims made by oil industry representatives were grounded in several analytical separations. First, by supporting loose, private-based environmental regulations, the oil companies sought to disentangle their offshore operations from the Mexican federal government's controlling "optic" and from the state authorities' regulatory norms in the fields of environmental safety and social responsibility. Second, through strict regulation of access to the marine zone of exclusion, the offshore was constructed as an isolated space of oil production to reduce the pressure of political confrontation. Third, by obscuring the links between global projects of hydrocarbon production and local experiences of resource exclusion, the oil industry decreased the opportunities for human-rights, social-justice, and other civic-advocate movements to claim compensation for local communities for burdens caused by exploration, and to campaign for a fairer distribution of benefits gained through oil extraction (Breglia, 2013; Quist and Nygren, 2015).

These conceptual separations in oil companies' truth claims, and in their lobbying of the policymakers and governmental authorities who supervised the oil industry's operations, made it extremely difficult for affected fisher communities to demonstrate evidence of harm and sue oil companies. Although many scientists find it difficult to separate between diverse, potentially interrelated phenomena in complex marine ecosystems (Borja, 2014), oil industry representatives affirmed that explorations carried out according to the prevailing rules and standards do not cause harm to anybody. Powerful arguments that downplayed the consequences to marine life of oil exploration were legitimated through historically shaped truth-makings that took place through paternalistic politics and hierarchical arenas of political representation where fishers' knowledges had scant opportunities to be taken into account.

6. Conclusion

While the intensification of hydrocarbon extraction in Latin America and globally involves growing concerns and conflicts prompted by the manifold uncertainties of oil extraction (Bebbington and Bury, 2013; Sawye, 2017), relatively few studies have been carried out on environmental-social unknowns concerning oil exploration. This study has examined how fishers, oil company representatives, and governmental authorities frame their arguments about the uncertainties related to marine oil exploration in Tabasco, southeastern Mexico. Inspired by Hacking's (2002) theorizations of historical ontology and Bachelard's (1970[1931–1932]) Bachelard, 1970 Bachelard's (1970[1931–1932]) Bachelard, 1970 Bachelard's (1970[1931–1932]) formulation of the phenomenotechnique, we have highlighted how understandings about unknown consequences of oil exploration come into being and are shaped by politically mediated practices of naming and interpreting. Drawing also upon Sawyer's (2017) and Salas Landa's (2016) analyses of competing claims about oil's toxicity, we have shown how different truth-claims about oil exploration's impact on local environments and livelihoods are negotiated and contested under historically shaped power relations and resource politics.

Our study provides a significant contribution to the study of contested knowledges and politically differentiated possibilities to get knowledge claims legitimized in the arenas of truth-making involved with extractive politics. We have illustrated how small-scale fishers' situated knowledges about the less visible consequences of oil extraction become delegitimized under the context of scientific uncertainty. Our results show how oil industry representatives legitimize claims that downplay the consequences of oil exploration on marine life by promoting universalizing truth-makings through hierarchical power relations. Oil company representatives either deny or minimize the impacts of oil exploration by presenting environmental and social dimensions as

separate and discrete, by isolating individual exploration events from each other, and by claiming that possible effects are transitional. These arguments rely primarily on evaluations that have been made for or by the oil industry.

Our study demonstrates how Tabascan fishers, through their watercraft, create situated knowledges about the sociospatial and temporal effects of oil exploration. In their claims about the disappearance of fish, fishers rely on their detailed understanding of fish behavior and of the fish' ways of reacting to seismic surveys, gained through following the shifting movements of the fish. While fishers' claims are rooted in the view that everything in the marine environment is potentially interconnected and unstable, oil companies engage in disputes about seismic surveys by categorically denying the likelihood of harmful causalities unless otherwise proven. Within prevailing power relations and politics of truth-making, fishers' situated knowledges and claims for a careful consideration of the oil exploration's effects on marine life and fishers' livelihoods have few chances to be taken into account.

Our examination of divergent truth-claims related to uncertain consequences of oil exploration provide perspectives to more general patterns of truth-making and governance between local communities and globalizing oil industries. As our study shows, the ways in which the oil extraction operations become evaluated through differentiated truth-making processes, enable considerable understatement of the potential harms of oil exploration to marine life and to people who depend on it.

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