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## A transdisciplinary approach to address the exclusion processes of the food regime for Mexico's small-scale fishers and farmers<sup>◇</sup>

### Un acercamiento transdisciplinario al proceso de exclusión del régimen de alimentación de los agricultores y pescadores de pequeña escala en México

**Abstract** | Mexico is one of the few countries that combine fishing and agricultural legacies. Despite the social importance and central role of food production, Mexican public policies have largely abandoned small-scale producers over the last four decades. Moreover, they have been relegated to the status of weakest link in the economic logic of the global food regime. Since Mexico signed the first North American Free Trade Agreement, small-scale fishers and farmers have faced five main problems: dismantling of means of production, erosion of organizational capabilities, disadvantageous commercial logic that limits access to favorable markets, westernization of diets, and frequent periods of food insecurity. This study addresses the following research question, how, in the face of the exclusion processes of the current food regime, the abandonment of public policies and erosion of most of the sectoral organizational capacities in Mexico, can small-scale fishers and farmers, as well as urban and rural consumers improve their productive, commercial and food prob-

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lems within their living contexts? We introduced a novel transdisciplinary context-specific approach, based on our research experience in fishing and farming communities of the Yucatan Peninsula. Finally, we outline innovation niches that could lead to relocate regional food systems through complementarities between coastal and inland areas.

**Keywords** | transdisciplinary | regime | small-scale producers | innovation niches | food complementarities.

**Resumen** | México es uno de los pocos países que combinan un gran legado pesquero y agrícola. No obstante, a pesar de sus contribuciones sociales y en la producción de alimentos, las políticas públicas mexicanas, en gran medida, han abandonado a los pequeños productores a lo largo de las últimas cuatro décadas. Además, se les ha relegado como el eslabón más débil dentro de las lógicas económicas del régimen alimentario mundial. Desde que México firmó el primer Tratado de Libre Comercio de América del Norte, los pescadores artesanales y los pequeños agricultores se han enfrentado a cinco problemas centrales: el desmantelamiento de los medios de producción, la erosión de las capacidades organizativas, lógicas comerciales desventajosas que limitan el acceso a mercados favorables, la occidentalización de las dietas y frecuentes periodos de inseguridad alimentaria. Este estudio aborda la siguiente pregunta de investigación, ¿cómo, frente a los procesos de exclusión del actual régimen alimentario, el abandono de las políticas públicas y la desarticulación de la mayoría de las capacidades organizativas sectoriales en México, pueden los pescadores y agricultores de pequeña escala, así como los consumidores urbanos y rurales, mejorar las realidades productivas, comerciales y alimentarias dentro de sus propios contextos de vida? Introducimos un enfoque transdisciplinario novedoso para un contexto específico, basado en nuestra experiencia de investigación con comunidades pesqueras y agrícolas de la Península de Yucatán. Finalmente, esbozamos nichos de innovación que podrían conducir a la relocalización de sistemas alimentarios regionales a través de complementariedades entre las zonas costeras y del interior.

**Palabras clave** | transdisciplinario | régimen | pequeños productores | nichos de innovación | complementariedades alimentarias.

## Introduction

MEXICO IS ONE OF THE FEW COUNTRIES that combine enormous fishing and agricultural legacies. It is one of the top 20 nations worldwide in terms of coastline (11,600 km), inland waters (2,500,000 ha), exclusive economic zone (3,000,000 km<sup>2</sup>) and fishing activity. Its fishing sector incorporates 69,000 small-scale fishers and 8,000 offshore or large-scale fleet fishers (88% men and 12% women). Small-scale fisheries commercially capture approximately 665 species, while the offshore fishery is dedicated to the capture of 48 species (Conapesca 2018). It is estimated that approximately one million families in Mexico are formally or in-

formally employed in pre and post-capture processes, with an increased participation of women during the initial and final stages of the commercial cycle (*Ibid*). Furthermore, Mexico is also one of the eight great centers of origin, domestication and diversification of plants (Harlan 1971). Close to 200 species of edible crops of great global food importance have their epicenter in Mexico (Casas *et al.* 2007). Currently, Mexican small-scale farmers are grouped into around 32,000 agrarian communities distributed in all the states of the country and covering around 90% of the municipalities nationwide, forming a sector of approximately six million families (Morett-Sánchez and Cosío-Ruiz 2017). Of the entire Mexican small-scale agriculture sector, 80% is represented by rural subsistence units with market linkages (FAO 2020). Despite this valuable fishing and agricultural legacy, Mexico is currently subsumed in a deep food and malnutrition crisis. According to the National Council for the Evaluation of Social Development Policy (Coneval, by its Spanish acronym), 55% of Mexican households present some manifestation of food insecurity, while 24% of the national population live under conditions of food poverty and 12% of the rural areas experience chronic malnutrition, including one million children (Coneval 2022). Of the national population living in food poverty, 70% are indigenous people, while one in four children with chronic malnutrition are indigenous (Ensanut 2018).

In order to analyze the paradoxical and complex food reality of Mexico, our study centers on the food regime approach. Coined by Friedmann and McMichael (1989), this approach allows us to analyze, from the theoretical bases of the political economy, the modern world-system and center-periphery, the dynamics and structuring of the rules and devices that govern the production, distribution and consumption of food on a global scale. Such rules and devices have been adjusted historically, and it is therefore possible to recognize different stages within the global food regime: the colonial, agro-industrial, supermarket revolution, and an ultimate stage of financial speculation and 'green' or 'blue' dispossessions (McMichael 2009).

In Mexico, people are subordinated to (neo)colonial trade logics in which we export quality food while importing second-rate products. For instance, we export finfish, mollusks and crustaceans to countries with high commercial standards such as the United States, Japan and Spain, and import fish fillets, among others, of frozen '*basá*' from China and Vietnam (Conapesca 2018). Despite ranging around the top 15 countries worldwide in fish catch, Mexico's annual *per capita* consumption of fish and seafood ranges around 13 kg, a value well below counterpart countries in terms of fisheries such as Japan, China, Norway, Portugal and Spain with values of 40 to 65 kg (Ensanut 2018).

Mexico also imports agricultural products comprising more than half of that consumed nationally, including maize and beans, the basis of the people's diet,

in exchange for elite exports such as avocado (Appendini 2014). Moreover, the agro-industrial regime has led to high dependence on chemical inputs in order to produce food. In this regard, around 80% of small agricultural production units in Mexico use at least one technology of the “Green Revolution” (Altieri *et al.* 2021). Another negative impact on small-scale producers has been the irruption of large national and transnational supermarket chains because, given their capacity for commercial monopolization of production, urban, peri-urban and rural consumers have turned to these spaces to satisfy a large part of their food requirements, not only for ultra-processed products, but also for fish, seafood and foods of agricultural origin (Schwentenius and Gómez 2008). Finally, to understand the small-scale producers’ exclusion process, the national susceptibility to food speculation and the increase in corporate agricultural frontiers due to the lack of price stabilization and regulation mechanisms must be considered, as well as the neglected regulation of agrarian and coastal dispossessions (Róles-Berlanga 2012).

The historical turning point from which the dynamics described began to be exacerbated was the neoliberal dawn of the 1970s and the implementation of the North American Free Trade Agreement (NAFTA) in 1994. Since then, Mexico has experienced what several authors have described as the disarticulation of national fisheries and agriculture (Calva 2019, 615), and the consequent development of food dependence (Barkin 1987). In the initial stages of neoliberalism in Mexico, fishing cooperatives (Cisneros-Mata *et al.* 2023) and farming organizations were dismantled, as well as effective state participation in popular food supply (Yúñez-Naude 2003). Thus, for small-scale fishing and farmer families, as well as for marginalized urban and peri-urban households, since NAFTA began (Gálvez 2018), there has been a strong tendency towards food insecurity and the double nutritional burden syndrome: the coexistence of overweightness and malnutrition (Varela-Silva *et al.* 2012). In farming households, protein deficits have been documented; in fishing households, there are dyslipidemia risks due to lack of eating habits that involve fruits, vegetables and cereals. This can be added to the fact that the diets of both groups share with those of poor urban and peri-urban households a high consumption of ultra-processed foods typical of the widespread ‘westernization’ of the Mexican diet (Popkin 1999).

Despite progressive discourse in the national public realm, following the recent transition of power from ‘pro-neoliberal’ to a ‘leftist’ government, policies for reducing public spending and the dynamics of dismantling the fishing and agricultural means of production have continued. As antagonistic as it may seem, the neoliberal paradox of post-neoliberal governments can be understood from the reasoning of neoliberalism as a structuring process and not only as a political ideology. Therefore, beyond changes in political representativeness, the factual

powers continue to reproduce themselves (Fletcher 2019): “neoliberalism, so long, we hardly knew you” (Keil 2009, 231). The fisheries sector has been one of the most affected by the leftist government: 22 of the 23 federal fisheries support programs have disappeared under the current administration (Cisneros-Mata *et al.* 2023). It is noteworthy that the budget for inspection and surveillance activities has almost disappeared, even though approximately 60% of the fish catch in Mexico is extracted without fishing permits, using irregular fishing gear, during closed fishing seasons or even illegally within marine protected areas. On the other hand, greater public efforts have been channeled into the agricultural sector led by the Ministry of Agriculture and Rural Development (SADER, by its Spanish acronym) where two antagonistic forces dispute its focus between the agroindustry and peasant-agroecology (Bazán Landeros and Torres-Mazuera 2021).

Regarding small-scale producers’ leadership, over the last four decades, a large majority of the fishing and farming organizations in Mexico have concentrated their power in old leaderships and have attended more to programs of political opportunism than to movements of social struggle (Carton de Grammont 2008). For instance, Mexican fishing and farmer organizations present very limited participation in international social movements of great importance in other Latin American contexts, such as the World Forum of Fisher Peoples and *La Via Campesina*.

Given this complex national panorama, in this paper we pose the following research question: how, in the face of the exclusion processes of the current food regime, abandonment of public policies and erosion of most of the sectoral organizational capacities in Mexico, can small-scale fishers and farmers, and urban and rural consumers be articulated in order to improve their productive, commercial, food and nutrition problems within their living contexts? Thus, the aim of the study is to outline a theoretical-methodological proposal, based on our experience and that of colleagues with decades of research in fishing and farming territories, in order to provide the scaffolding for the transdisciplinary articulation of complementary and alternative territorial circuits of production-distribution-consumption that connect coastal areas, the rural inland and small-medium cities on a micro or meso-regional scale, from which food systems can be relocated without compromising the fishing and agricultural resource base. In such articulation, collaboration between fishing and farmers’ families and organizations themselves, as well as NGOs, academics and government are of utmost importance, which has a high potential to occur given the previous collaborative networks that already exist in many Mexican territories (e.g., Herrera and Guerrero-Jiménez 2020; Bello-Baltazar *et al.* 2020). It will also be of utmost relevance to find mechanisms for the participation of a whole critical mass of reflexive consumers, capable of demanding fairer forms of food commercialization, such as nested markets (Van der Ploeg *et al.* 2022).

The article is structured in six sections. After this introduction, the second part describes the transdisciplinary methodological approach, and the third part introduces the Yucatan Peninsula (YP) as a case study, describing the problems currently faced by its small-scale fishers and farmers. The fourth part analyzes the type of results that could be obtained of the proposed approach, while fifth section focuses on discussing challenges and limitations of the proposal. The final part contains concluding remarks considering the scope of this proposal in terms of its application to other related contexts in Mexico and in Latin America.

### The transdisciplinary approach

The whole research approach comprises a combination of theoretical concepts and analytical frameworks, which have been developed over several decades, primarily by scholars from Mexico and other regions of Latin America, although we also incorporate some reflections of international scope, such as the study of food regimes and transdisciplinary discussions. In particular, the development of the study benefited from our participation in the following five specific academic-social-political interface experiences: 1) the organization of the international seminar “Dialogues for the construction of agri-food sovereignty and security in Mexico” held in 2020, in which a group of 60 academics, government officials and leaders of national and international organizations debated the productive and food paths of the country (<https://www.iis.unam.mx/soberania-agroalimentaria/>); 2) publication of the book *Socio-environmental regimes and local visions: transdisciplinary experiences in Latin America*, which provides a transdisciplinary framework to address different socio-environmental regimes using case studies from seven Latin American countries (Arce-Ibarra *et al.* 2020); 3) our collaborative work in multidisciplinary groups or research and influence teams (RIT) involving the development of two project proposals, namely “Artisanal fishing and food sovereignty: innovation niches to promote consumption and expand the distribution of fishery products in the Yucatan Peninsula” and “Popular and solidary agri-food trade corridor between *milpera* and *Puuc* regions in Yucatan” funded by the Mexican National Council of Science and Technology (Conacyt, most recently Conahcyt, by its Spanish acronym), to address national issues using an integrated approach to innovation and influence; 4) our experience participating in platforms, networks and social movements related to fisheries and agriculture, including the Community Conservation Research Network (CCRN, <https://www.communityconservation.net/>), the Too Big To Ignore: Global Partnership for Small-Scale Fisheries Research (<http://toobigtoignore.net/>), and the technical team of *La Via Campesina* North America; and finally, 5) our collaborative field work, conducted over a period of almost three decades, with fishing

and farming communities of the YP, which leads us to empirically illustrate the proposed approach for this specific regional context.

### *Leveling the common theoretical ground*

Our methodology is based on what we have called the transdisciplinary approach to research and influence (TARI). In Mexico, from 2019 to date, Conacyt (Conahcyt) has promoted influence or social transformation as part of research projects that seek to solve the country's most pressing problems, including the quest for and promotion of national food sovereignty. In particular, the idea of 'influence' implies promoting the improvements, change or social transformation required to partially or totally solve the addressed research problems (García-Barrios 2019).

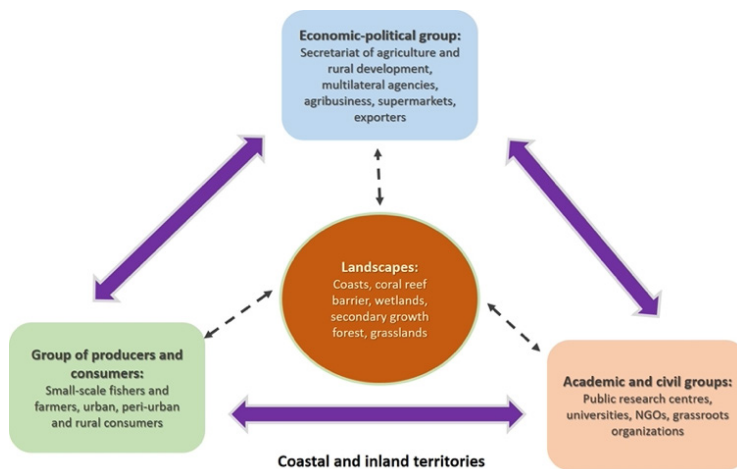
Thus, a TARI begins with the formation of a multidisciplinary working group called the research and influence team (RIT), which is responsible for the entire process of the research project. Based on interpellation with the subjects and social realities of the study area, the RIT seeks to move the research process towards a transdisciplinary realm. The RIT is generally composed of experts with different specialties. By working and interacting within a RIT, participants should recognize that they work "in dialogue with the different" (Merçon *et al.* 2021, 199). Some operational ground rules of collaboration are that, in general, the RIT does not work in a top-down manner guided by any leader, but rather the participants work horizontally, with leadership that is most often rotated, promoting empathy and an openness to be able to teach, and learn from, any of the people involved in the RIT (see Chuenpagdee and Jentoft 2019; Bello-Baltazar *et al.* 2020). The main tasks of the RIT are: i) selection of a theoretical-conceptual framework for the research; ii) analysis and discussion of the philosophical bases of the type of transdisciplinarity that the study will employ; iii) identification of the research and influence problem to be addressed, as well as selection of the study area; and, iv) carrying out the required fieldwork, analysis of the results, and socialization of the insights resulting from the research with the communities of the study area.

Regarding the conceptual framework for the research (although each RIT would choose one that suits its conditions), here we propose the model of local socio-environmental systems (LSES) as a basis for reflection (Parra-Vázquez *et al.* 2020) (figure 1). The LSES portrayed in figure 1 is a production system in which it is explicitly recognized that its functioning has been conditioned for several decades by the rules imposed by the global multilevel food regime. Under this premise, the possibility of small-scale producers maneuvering to make major changes within the system is limited (Parra-Vázquez *et al.* 2020). A LSES refers to a complex small-scale production system, located in coastal-marine (fishing)



and/or terrestrial (agricultural) territories. Each production system uses the landscape units contained in its territory as resource base or as inputs. Three main human groups interact in each LSES: a) group of producers and consumers; b) the socio-academic group, which can include people with various profiles, for example, professionals, researchers and representatives of NGOs; and, c) the economic-political group comprising government officials from the three levels of administration, as well as middlemen and entrepreneurs (figure 1).

**Figure 1.** The local socio-environmental system (LSES) model as a basis for reflection of our methodological approach.



Source: Adapted from Parra-Vázquez *et al.* (2020).

With respect to the transdisciplinary philosophical bases that the research will use, there are different positions and schools of thought offered by the literature, from Piaget (1972) to the most recent reflections published for the Mexican and Latin American contexts (Merçon *et al.* 2021). Since we recognize that each RIT must organize its own exercise for each territorial context where any study is carried out, the following paragraphs only present some reflections, which are basically related to our own conception of one, among other possible transdisciplinary approaches.

Literature review reveals that there are different definitions of the words transdisciplinary and transdisciplinarity. In reviewing their etymological origin, Basarab Nicolescu reports that the prefix “trans” “is a Latin word meaning at the same time, in between, across, and beyond.” (Volckmann 2007, 78). In other words, “Transdisciplinarity is completely different [to interdisciplinarity] in the sense that it puts the problem of the information that circulates in between dis-



ciplines, across disciplines, and even beyond any discipline” (Volckmann 2007, 77). Furthermore, Nicolescu postulates that transdisciplinarity is a context in which it is recognized that there are “different levels of reality” (Volckmann 2007, 80) in different domains of the world.

Nicolescu’s proposal of different levels of reality also applies to domains of human society. In this regard, we extend this idea to the formation and development of the RIT: “There are levels in ourselves, in our own understanding, representation, languages and so on, and even levels of reality of the Subject” (Volckmann 2007, 80). If this complexity of reality is recognized, then the contributions of each member of the RIT require consideration and discussion that, most probably, ‘the different ones’ in dialogue—including the communities in which the study is developed— will collaborate from different levels of reality, as well as from different worldviews.

Other complementary views on transdisciplinarity indicate that it is the amalgamation of scientific knowledge with social practices (Lang *et al.* 2012), which is context-specific and where power relations and interculturality generally emerge (Zamora 2020; Bello-Baltazar *et al.* 2020). Several authors recognize transdisciplinarity as a relatively new concept (Choi and Pak 2006; Volckman 2007) one that can be conceived as a tool, but also as an intrinsically unfinished project permanently under construction (Max-Neef 2005).

### *A practical component of transdisciplinary approaches*

From our own experience, one of the practical components of a transdisciplinary approach involves ‘how to integrate’ the parts of a whole (i.e., the story of the project, from start to finish), and relates to moving from the multidisciplinary or additive aspect of the research process, first to an interdisciplinary realm, and then to transdisciplinarity (Arce-Ibarra *et al.* 2020). We have conducted this exercise by selecting and discussing key categories that serve as the explicit axes, or ‘bridging’ concepts, used as threads that run transversally through the research process (see Arce-Ibarra and Gastelú-Martínez 2007; Puc-Alcocer *et al.* 2019). To examine the exclusion processes of the global food regime, we have chosen the concepts of ‘food regime’ (from political economy), ‘territorial production-consumption circuit’ (from economic anthropology) and ‘territorial innovation niche’ (from ecology, transitions literature, and political sociology), as the key interrelated concepts. From these concepts, with the participation of the RIT and the beneficiary social subjects of the study area, knowledge and influence can be created while weaving the story of the study. We refer to a territorial production-consumption circuit (TPCC), also known in the literature as a value chain (Coronado *et al.* 2020), as the productive process in which the participating social subjects and their interactions are analyzed,

from obtaining the raw materials to consumption, through processing, distribution and commercialization. A TPCC can be mapped, and its types of interactions identified and analyzed, including the power relationships (Coronado *et al.* 2020). When it is considered necessary to make changes or modify a TPCC (for example, to create more sales or consumption access points for certain users), it is necessary for the social actors involved to analyze the process and identify innovation niches to carry out the proposed modifications. According to Ingram (2015), an innovation niche is composed of sources of ideas and areas of opportunity that generally become new practices and actions, which, being outside the *status quo*, represent a challenge to that which is already established, in this case, the global food regime.

Regarding the epistemological bases for creating knowledge, and considering Nicolescu's levels of reality, we argue that it will most likely be impossible for the RIT to subscribe to a single paradigm of knowledge. Instead, we propose using epistemological pluralism (Miller *et al.* 2009) with elements of critical interculturality, since all the voices of the social subjects in the area of influence must be included (McDonell 2000; Zamora 2020). We refer to epistemological pluralism, because there will be a common arena (e.g., those spaces of collaborative work) in which the encounter and incommensurability of various ways of creating knowledge, from orthodox to emerging paradigms or sociologies (e.g., De Sousa Santos 2009), will be allowed. This provides an opportunity to be inclusive and to consider the diversity of ways of working of the different RIT members. However, for each way of creating knowledge, each member (or subgroup) of the RIT will present seminars at the working meetings, where they will show the benefits and criticisms of the particular epistemological paradigm to which they subscribe. In addition, they must show: a) how their paradigm considers (or excludes) the voices and worldviews of marginalized groups —such as small-scale fishers, farmers and popular consumers; b) how they would combine their results with the social and cultural practices of the territorial circuits under study; and, c), how the paradigm they use contributes to the social transformation required in the research and influence project (*sensu* García-Barríos 2019).

### *Research methods*

To carry out this type of study, we propose a combination of qualitative and quantitative research methods, all forming part of the participatory action research (Park 1992). Qualitative methods refer to the use of ethnographic techniques, participant observation, community meetings and workshops, focus groups, life stories, social network analysis, social mapping, and the elaboration of photographic or video documentary memories —all with the informed consent of the social subjects (Bernard 1995). Quantitative methods comprise parametric and

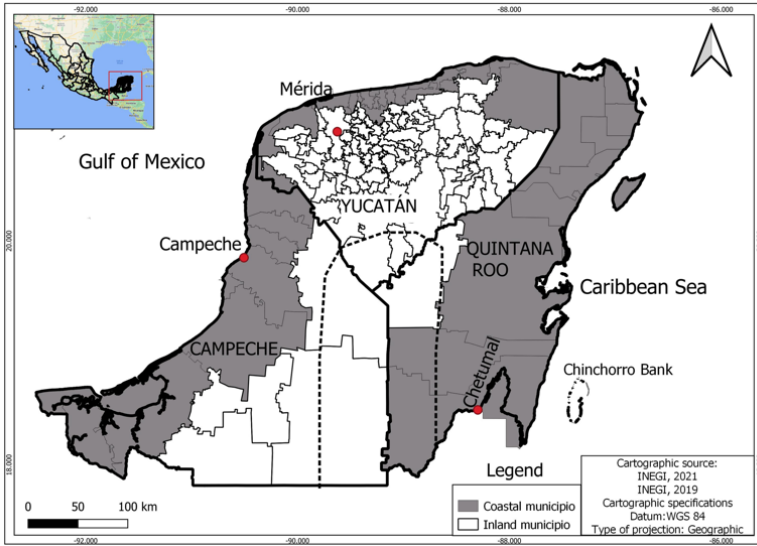
nonparametric techniques (Ramsey and Schafer 2002). Likewise, we propose to consider a third conglomerate of heterodox methodological and epistemic tools typical of complexity sciences (Rivera-Núñez *et al.* 2021) that seek to move from analysis to synthesis and to the integration and multi-actor discussion of results. The methodological approaches include the companion modeling, agent-based computational simulations and serious socio-ecological board games (García-Barríos *et al.* 2016; De La Cruz *et al.* 2023).

Lastly, as part of the participatory action research cycle, it is essential to systematize research processes and influencing experiences (Jara Holliday 2012), as well as to generate explicit spaces for social learning (Reed *et al.* 2010). Social learning refers to a higher order of discernment in which the RIT can challenge (or entrench) previous values, norms and beliefs in order to collectively deepen the constraints and opportunities that presuppose the quests for transformation or territorial niches of innovation within given socio-environmental regimes (Fazey 2010).

### **The Yucatan Peninsula as a case study**

We selected the Yucatan Peninsula (YP) in order to illustrate the proposed transdisciplinary approach. This region, comprising the three states of Campeche, Yucatan and Quintana Roo, is in southeastern Mexico and has an area of 181,000 km<sup>2</sup> and a population of almost 5 million inhabitants (Jouault *et al.* 2022). The YP is part of the ancestral territory of the Mayan people who settled in this area at least 5000 years ago (Rivera-Núñez *et al.* 2020). In the 21<sup>st</sup> century, the Mayan culture is expressed in the YP, among other things, through the use of Yucatec Mayan language, which is spoken by nearly one million people in nearly one thousand rural and coastal communities in this area (Bello and Estrada Lugo 2011). The culture is also expressed through the practice of slash-and-burnt shifting agriculture called *milpa*. It is estimated that approximately 50% of the population of the YP lives in coastal communities (Coronado *et al.* 2020) and about 80% of the population occupying inland territories live less than 200 km from the coast (see figure 2). However, except for periods of food constraint, such as those caused by the sanitary contingencies of recent years, there is little exchange and trade between the fishing and farming communities (figure 3). The presence of these people and their traditions in the area implies that, when this study is conducted therein, the RIT will encounter social actors with culturally diverse local knowledge—from either the environmental, fishing or agriculturist realms. It is with these people and their worldviews that the RIT is expecting to devise problem-solving strategies related to their fishing and agricultural production and commercial systems.

**Figure 2.** Area of study for the transdisciplinary research approach. Coastal municipalities are shaded and a zone of influence extending to 200 km in distance from the coast is delimited in dotted lines.



Source: Produced by M. C. Saida Ochoa Huchin.

**Figure 3.** Solidarity exchanges of fish for fruits and vegetables among small-scale producers of the coastal municipality of Dzilam de Bravo and the inland municipalities of Dzilam González and Dzidzantún, Yucatan, during the COVID-19 pandemic in 2020.



Source: Alianza Peninsular para el Turismo Comunitario.

### *The research and influence problem*

In general terms, despite the importance of primary sector activity in the YP, only 52% of the total population in Campeche, 60.3% in Yucatan and 65.1% in Quintana Roo had achieved food security by 2018 (Coneval 2022). These values may vary depending on socio-environmental (e.g., presence of prolonged droughts or hurricanes), socio-economic (high rates of migration of young people from rural areas to urban and touristic areas) and political (presence of programs that encourage production) factors.

In the last decade, YP's fisheries operated with 675 semi-industrial fleet vessels and 10,916 artisanal fleet boats. Considering both fleets, close to 27,000 individual fishers were employed (Conapesca 2018; Coronado 2020). YP's small-scale fishing systems are in coastal-marine areas where, depending on the time of the year, closed seasons and the depth at which they are fished, fish, elasmobranchs and invertebrates can be caught using a variety of fishing gear (such as hand lines, fishing lines, gill nets, free or apnea diving, 'hooka' or compressor diving, and 'jimba', among others). Once the fishery product is caught, it is landed at the docks of each community to continue through the network that makes up the territorial circuit of distribution, marketing and consumption of fish and seafood (TPCC). Species of higher economic value (such as octopus, lobster, or some fish such as grouper and hogfish) are marketed either to the local tourist market or delivered to processing plants, while medium and low value species are sold in the same locality and form part of the domestic consumption in the households of the fishers themselves.

Despite the size and contribution of the sector to local, national and international food systems, the literature reports (and the fishers themselves recognize) that the coastal fishing sector faces several problems, including the fact that several species are overexploited, and their catches are declining (table 1) (Arguín-Sánchez and Arcos-Huitrón 2011; Bravo-Zavala *et al.* 2022). Another striking problem is the difficulty of marketing medium and low economic value products in regional and national markets (J.C.C.N. fisher from Telchac Puerto, personal communication, October 2021).

The artisanal fishing sector has various distribution and marketing strategies for species of high economic value (e.g., lobster and octopus), which are sold in several tourist centers of the region (e.g., Cancun, Playa del Carmen), as well as exported to markets in Europe, Asia and the United States (Coronado *et al.* 2020). However, products of medium and low economic value (several species of bony fish) face market problems. There was a marketing crisis during the confinement periods of the coronavirus pandemic, from March to July 2020 (Cobi 2020). On the other hand, the fishers have few strategies to market their lower value catches to non-coastal rural communities, where the diet of middle and

low-income people includes almost no fish (Becerril 2013). In this sense, the problem of commercialization and markets for fish products also negatively affects the equitable distribution of the food and nutritional benefits of fish (*sensu* Alcocer-Flores 2015) among the regional population, particularly those suffering from health and nutrition problems, which are largely those of middle and low income.

On the other hand, the agricultural systems of the Mayan farmer's communities in the YP revolve around four central production units: the *milpa*, the forest, home gardens and cash-crop plots. Particularly in communities that continue to practice agriculture with traditional features, planting of the *milpa* is combined with the harvesting of the forests based on an agroforestry-type management scheme. Home gardens are backyard areas surrounding Maya houses that contain cultivated plants, animals and infrastructure are worked by the families themselves. Therefore they represent multifunctional agroecosystems of agricultural, forestry and livestock. Finally, in addition to the millenary agroforestry systems described above, government programs in several rural regions of the YP from the 1960s and 1970s onwards promoted irrigation production schemes for the commercialization of around 60 fruit and vegetable species in regional tourist, national and international markets (Lazos *et al.* 2022).

The main problems of the agricultural sector are productive, commercial, and food, which encompasses six main links of the TPCC circuit (table 1). Above all, since the 1980s and 1990s, under public programs for the modernization of rural Mexico, *milpa* agriculture began to undergo a process of simplification due to increasing use of agro-industrial inputs. The simplification of the *milpa* has reached the extremes of hybrid maize monoculture (or bicultivation with beans) with the use of herbicides, pesticides, fungicides and chemical fertilizers, which is causing problems of soil fertility loss, soil and groundwater contamination, reduced agrodiversity, and abandonment of fallow land, among others. In commercial terms, the agricultural production regularly faces very low distribution capacities and, consequently, prices that are severely manipulated by voracious regional intermediaries. Most of the international arrangements for commercialization of citrus fruits collapsed decades ago and, during the sanitary contingency, historic low prices were recorded for most citrus fruits, vegetables, as well as maize and honey (Lazos *et al.* 2022). The low prices made the harvest of the crops themselves unviable, and significant food waste occurred due to the abandonment of production in the plots. It is also important to note that farmers tend to recurrently report annual seasons of undernourishment, especially during the renewal months of the agricultural cycle when the production of basic self-sufficiency crops from the previous year begins to run out. In general terms, as indicated in the introduction, fishers and farmers in the YP have both been experiencing a pro-



cess of transition from their traditional diets towards western consumption models of ultra-processed products with high intakes of saturated fats and refined sugars and low intakes of fiber and vitamins.

**Table 1.** Vulnerabilities faced by small-scale fishers and farmers of the Yucatan Peninsula within their territorial circuits of production-consumption, due to rules imposed by the global food regime.

TPCC link	Key vulnerabilities	
	Artisanal fishers	Small-scale farmers
1. Extraction / Production	Overexploitation of resources; illegal fishing; lack of generational replacement; blue dispossession.	Dependence on industrial inputs; soil depletion; low yields; production losses; lack of generational replacement; green dispossession.
2. Storage	Lack of household and community infrastructure; catch losses due to the highly perishable nature of the resources.	Lack of household and community infrastructure; loss of harvests.
3. Processing	Abandonment of food preservation and transformation processes for seafood products.	Low levels of the processing skills required for extending shelf life and adding value to foodstuffs.
4. Distribution	Private monopolization of transport capacity at scale, imposing high freight rates; relatively high export and concentration of marketing to the large regional tourism sector; low direct sales to consumers and no public procurement of production.	Low transport capacity; high freight rates; lack of knowledge of market prices; voracious coyotage and commercial concentration of production; few direct sales to consumers and no public procurement of production.
5. Consumption	Generally low purchasing power; Westernized diets; relative loss of local gastronomy; erosion of food reciprocity; lack of associative figures for social supply.	Low purchasing power; westernized diets; relative loss of local gastronomy; erosion of food reciprocity; no associative figures for social supply.
6. Waste	Discarded catch; food waste; low capacities for utilization of special handling waste; environmental contamination and sanitary problems.	Food waste; human and environmental contamination from chemical residues and burning of agricultural waste.

Source: Own authorship.

## Expected results

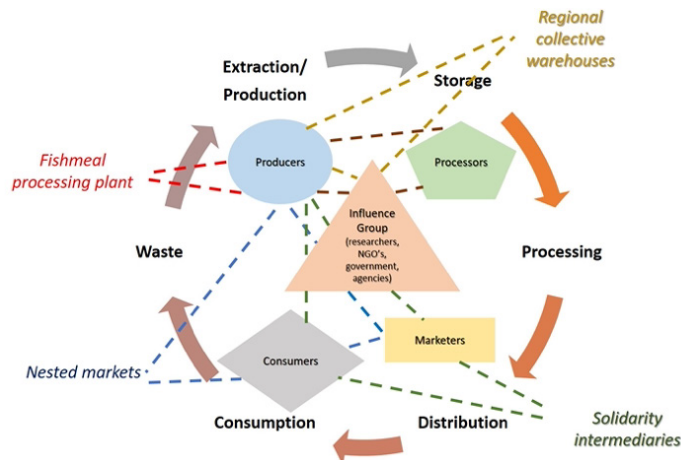
The first expected output would be a list of the species that make up the fishery and agricultural products produced by the systems under study. The second output, which is considered key for this type of study, is a participatory mapping of TPCC bottlenecks and innovation niches in which the transdisciplinary team establishes multi-stakeholder alliances and the mobilization of actions that could be leveraged to begin the transition towards fairer and relocated food systems



(figure 4). It is expected that the map obtained will also be presented to the rest of the social actors that form the nodes of the study area (processors-distributors, marketers and consumers) for their information and feedback. Based on their analysis and contributions, they will have proposals for new practices that can be complementary to the alternatives proposed by the small-scale producers. As examples of new practices related to food systems that have taken place in different Mexican territories, the following four major niches of territorial innovation that could arise in the methodological case in question are listed below:

- i. Implementation of a regional food relocation action plan: based on food complementarity between coastal and inland areas, as well as proximity access for urban and peri-urban popular sectors.
- ii. Development of a lobbying agenda for national and international funds, as well as regional alliances: to expand local storage and processing capacities for fishery and agricultural products and promote new production mobility schemes that include the acquisition of community means of transportation, as well as chartering and solidarity intermediation systems.
- iii. Holding of a series of workshops aimed at promoting food culture and nutritional health: based on the consumption of regionally produced fish and agricultural foods and the recovery of local gastronomies.
- iv. Promotion of social economy schemes: to encourage the emergence of associative figures of production, consumption, savings and loans that favor the supply of food within local livelihoods.

**Figure 4.** Participatory mapping of opportunities for niche innovation in the local food system based on the establishment of synergies between actors in the territorial production-consumption circuit.



Source: Own authorship.

## Challenges and limitations of the proposal

A first possible obstacle to carrying out the proposal is financial, given that adequate funding must be sought for it. We also agree with the proposal of García-Barrios (2019, 10), who states that the potential obstacles in any Mexican and Latin American research and transformation project, such as the one presented here, could be of three types:

“1) The obstacles to design and build the appropriate intervention instruments; 2) the obstacles to form the social subjects willing and able to transform the situation; and, 3) the obstacles (legal, ethical, cultural, etc.) to transform the field of action.”

To point 2, it should be added that “Such cooperation should be led by well-organized regional communities” (García-Barrios 2019, 9). In the Mexican case, this implies a problem because the neoliberal governments of past periods implemented subsidy programs of a welfare nature, which accustomed many communities to be passive and not to exercise their own initiative in seeking local solutions to their productive problems. This represents a challenge for research and transformation projects, especially for the Mexican fishing sector, where some small-scale fishers have recently informed us that their sector suffers from considerable organizational problems (see also Cisneros-Mata *et al.* 2023).

One of the most important obstacles could be of an economic-political nature. For example, we foresee that, once the RIT collect the data of the social and commercial subjects that form the map of the current TPCC circuits of fish and agricultural products, it will also become known which of them have more economic and political power. That is, more decision-making power over the structure and function of the studied circuit in the fishing sector; as researchers did in the TPCC circuit of octopus (Coronado *et al.* 2020), as well for beef in the peasant farming sector studied by Rivera-Núñez *et al.* (2020). Our expectation is, as has been seen in other territorial TPCC circuits in Mexico and Latin America, that those with the greatest economic-political power will be the social subjects of the group of entrepreneurs, who generally have the support of the authorities such that, as a whole, they are referred to as the economic-political group; while those with less power will be the small-scale fishers and farmers themselves (Bello-Baltazar *et al.* 2020; Coronado *et al.* 2020). A possible constraint to any transformation of the *status quo* will therefore be whether the balance of power would allow the new practices or innovation niches proposed by small-scale producers in the territorial TPCC circuits to be carried out.

## Concluding remarks

The exclusion processes of the global food regime for small-scale fishers and farmers in Mexico can be approached from several perspectives. The present study used our context-specific transdisciplinary experience, which derives from almost three decades of working closely with local communities, civil organizations, government agencies and research groups in the Yucatan Peninsula. Consequently, we have identified that the complex processes of exclusion of the global food regime act under a structuring process of neoliberalism where, to date, there has been a gradual dismantling of Mexican fishing and agricultural means of production, commercial organization and food sovereignty. Such productive, commercial and food dismantling is the result of how the nation-State respond to the logics of global agreements known as “conditionality lending” (De Moerloose 2014; Vordtriede 2019, 1), where signatory countries, like Mexico, modify their laws and carry out structural reforms following a development agenda dictated by the financial institutions that grant them the loans. The conditionality lending encompassing modification of national laws together with structural reforms has been taking place in other Latin American countries as well, including Argentina, Bolivia, Brazil, Cuba, Colombia, and Honduras (Bello- Baltazar *et al.* 2020). In the case analyzed in our study, since small-scale producers are at the bottom of the market linkage, they present precarious income conditions and very little maneuverability in terms of their commercial process in regional and national markets. As a result, many coastal and agricultural communities tend towards food insecurity. In relation to this problem, we do not consider that the Mexican government has the full capacity to maneuver in the short term to help these food systems and rural producers to improve their situation. Our proposed transdisciplinary approach is therefore based on the argument that collaboration between social subjects of the LSES, mainly between the group of producers and academia, is fundamental in order to reverse the conditions of vulnerability imposed by global food regimes in those territories without explicit manifestations of social mobilization (Herrera and Guerrero-Jiménez 2020). Other actors, such as thoughtful consumers and solidarity intermediaries, must play a central role in collaborating to construct new local commercial networks or nested markets (Van der Ploeg *et al.* 2022) and a place-based food culture, given the lack of localized scope of public policies. In this collaboration, mainly fishers and farmers will make use of their visions to identify and enable innovation niches, in such a way that will allow them to articulate in complementary TPCC circuits of fish (of medium and lower economic value) and basic agricultural products that connect coastal areas, the rural hinterland and small and medium-sized cities within micro or meso regional contexts.

In order to confront the food regime, beyond prescribing some of the demarcated ideological and mobilizing positions that have already figured in the heated international food debate (such as food security, food sovereignty, food self-sufficiency, the right to food, food autonomy, among others), we have chosen to outline those operational features that can lead to the relocation of the food systems. In our bid for food relocation, the complementarities between fishing and farmer communities, as well as between small and medium cities play a central role, due to the geographical proximity of less than 200 km between coastal and inland areas that occurs in the Yucatan Peninsula, as well as in many regional contexts of the country, mainly in the west, south-southeast and Gulf of Mexico. It is possible to put into practice the transdisciplinary proposal outlined in this work, because during the COVID-19 sanitary contingency we witnessed the solidarity food complementarities between small-scale fishing and farming families in contiguous communities, as well as the emergence of alternative food supply networks in the cities and in rur-urban areas of the Yucatan Peninsula. Lastly, we consider that this proposal is broadly flexible for use in multiple contexts that share the fishing, agricultural and popular consumer proximity, mainly in the Global South and with some focus on the Latin American region. **ID**

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