Urban Amazonians use fishing as a strategy for coping with food insecurity

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Abstract Fishing provides livelihoods and food for millions of people in the Global South yet inland fisheries are under-researched and neglected in food and nutrition policy. This paper goes beyond the rural focus of existing research and examines how urban households may use fishing as a livelihood strategy for coping with food insecurity. Our study in Brazilian Amazonia is based on a random sample of households (n=798) in four remote riverine towns. We quantitatively examine the inter-connections between fishing and food insecurity, and find that fishing is a widespread coping strategy among disadvantaged, food insecure households. Fisher households tend to be highly-dependent on eating fish, and for these households, consuming fish more often is associated with a modest reduction in food insecurity risks. Fishing provides monthly non-monetary income worth ≤USD54 (equivalent to ~12% of mean monetary income), potentially reducing food insecurity risks almost as much as the conditional cash transfer *Bolsa Família.* We estimate that nearly half a million inhabitants of the region's remote, riverine urban centres are directly dependent on a household member catching fish, a nutritious and culturally-preferred food. Consequently, small-scale urban fishers must be recognized in policy debates around food and nutrition security and management of natural resources.

Keywords: towns; capture fisheries; safety net; diet; natural resources

Introduction

Food insecurity and malnutrition are increasingly urbanized (Crush & Caesar, 2014; Kimani-Murage et al., 2014; Ruel et al., 2017), yet development agencies continue to frame these as predominantly rural problems (Battersby, 2017). Critical is that urban food insecurity and malnutrition is largely an outcome of poverty and related barriers in accessing affordable, nutritious food, rather than due to insufficient availability (Frayne et al., 2014). We engage with Tacoli's (2017) call for research and policy attention around livelihoods which may enable the urban poor cope with food insecurity.

Our paper's contribution is engaging with inland (non-marine) small-scale fishing as a livelihood through which urban households may be able to access nutritious and favoured foods and support their food security. Small-scale fisheries provide livelihoods for millions of rural people and make important, broader contributions to food and nutrition security (Belton & Thilsted, 2014; HLPE 2014; Loring et al., 2019). Importantly, fishing can provide poor households with welfare benefits through cash income *and* food (Béné, 2009; Hartje et al., 2018). Numerous studies explore related challenges around fisheries governance, access and sustainable use, and inter-linkages with marginalization and pro-poor development (see Béné et al., 2010). Yet urban small-scale fisheries are practically un-studied despite their enormous relevance poverty alleviation and food insecurity policies (Kadfak, 2019). Accordingly, our study helps initiate an *urban* dimension within on-going debates about how small-scale fisheries contribute to food security and poverty alleviation in the Global South (Béné et al., 2016). Specifically, we focus on small-scale fishing as a livelihood activity for coping with poverty and food insecurity in Amazonia's

riverine provincial towns, far from major deforestation frontiers.

Neglect of small-scale inland fisheries

The benefits of inland capture fisheries for food security and livelihoods are poorly understood, especially in comparison to marine fisheries and aquaculture (Funge-Smith & Bennett, 2019). Small-scale fisheries offer significant ecological and social benefits relative to large-scale fishing, but are long neglected by scientists and policy-makers due to historical dominance of monitoring paradigms for industrial fishing in the Northern hemisphere (Kolding et al., 2014). Consequently, inland fisheries are considered 'invisible' resources due to deficient monitoring and under-reporting, and they are largely ignored in food and nutrition policies (Lynch et al., 2017). For instance, inland fisheries provide over 40% of reported finfish production (Lynch et al., 2016) yet are overlooked in the Sustainable Development Goals (Thilsted et al., 2016). Cooke et al. (2016) argue that research assessing the importance of inland fisheries for food security and livelihoods is essential for integrating these systems into water management policy frameworks. Importantly, food insecurity causes imbalanced, less diverse and poor-quality diets, and when severe or long-term, induces malnutrition (Moradi et al. 2019). Fishes provide vital sources of energy, protein, micro-nutrients (e.g., bioavailable calcium, zinc, iron) and omega-3 fatty acids important for child and maternal health (HLPE 2014; Thilsted et al., 2016).

Within the fisheries literature there is an evolving, complex understanding of the linkages between poverty, vulnerability and food insecurity. Earlier research tended to convey

rural small-scale fishers in the Global South as the 'poorest of the poor'. The fisheries sector was considered to represent the most disadvantaged rural people (Béné et al., 2001). Hence, fishing was framed as a livelihood of last resort for the chronically poor, reflecting the low productivity of this sector (see Béné, 2003). Although poverty can be transitory rather than chronic, even non-poor fishers can be highly vulnerable, through high exposure to shocks and stressors (e.g., this study from Democratic Republic of the Congo, Béné, 2009). Yet, recent commentary emphasizes how inland fisheries – which are mainly small-scale – can provide complimentary livelihoods and a safety net for the poor due to low entry barriers (Lynch et al., 2017). For instance, a large proportion of the littoral-sector fishers in Lake Tanganyika have other primary livelihoods (Lowe et al., 2019). Furthermore, in the Mekong, instead of representing a poverty trap, fishing enables households to reduce their food expenditure and reduce seasonal food insecurity (Hartje et al., 2016).

Provincial urban poverty

High rates of poverty and rapid population growth in smaller urban centers lead Christiaensen and Kanbur (2017) to advocate reorienting public policy from its current metropolitan bias towards smaller towns. Ferré et al. (2012) find people living in smaller cities tend to be significantly poorer than their metropolitan counterparts. In Brazil, the trend is severe and, moreover, rural out-migrants arriving in these towns tend to experience deepening poverty in the years following arrival (Belik, 2015).

In Amazonia, rapid urbanization has contributed to the vulnerability of urban populations

(Mansur et al., 2016). Poverty and inequality in the region is also partly associated with relative inaccessibility. For example, imported foodstuffs are more expensive in remote riverine towns, exacerbating the challenges of limited employment and low incomes (Parry et al., 2018). They calculate over 900 thousand people live in 68 such towns, and find provision of education and healthcare is relatively weak in these places. Research in four of these towns shows high rates of childhood stunting and anemia (Orellana et al. Unpublished data). Given that road-building in Amazonia preempts migration, social turmoil and disease outbreaks (Barcellos et al., 2010), and drives deforestation and climatic change (Tallman et al., 2020), support is required to foster sustainable development pathways (and related livelihoods) in these towns. Amazonia's small-scale fisheries may contribute to one such pathway.

Amazonia's important inland fishery

In Amazonia, there is strong evidence that fishing and fish consumption are important in supporting riverine traditional populations, which are often poor and marginalized. Dietary dependence on fish is very high in the region, particularly among the rural poor. Rural Amazonians consume high quantities of fish (sometimes exceeding 200 kg/person/year (Isaac & Almeida, 2011)) which contributes vital dietary protein in the context of a relatively non-diverse staple-food diet (Murrieta & Dufour, 2004; Silva, 2009). In Amazonia, there is long-standing interest in the practices of rural fishing communities, and commercial fleets feeding big cities (Batista & Petrere Júnior, 2003; Junior & Batista, 2019), and international markets (Moraes et al., 2010). Three decades

ago, Bayley and Petrere (1989) estimated that 61% of the Amazon fishery's yield was from local market and subsistence fishers yet small-scale fishers in smaller towns remain overlooked, and the invisibility of urban and rural semi-subsistence fishing contributes to under-estimation of landings (Lorenzen et al., 2006).

One of the few studies of wildlife-use among urban Amazonian populations found that income poverty was a significant predictor of engaging in fishing (Parry et al., 2014). Moreover, around four-fifths of households in small urban centres ate fish nearly every day. Around half of the poorest households reported fishing whereas fishing was much less common among non-poor households (Parry et al., 2014, Figure 3). Pedrosa et al. (2018) studied metropolitan estuarine fishers and shellfish gatherers in North-East Brazil, finding that urban fishers were somewhat invisible to policy-makers and had weak relationships with environmental and fisheries institutions. In addition, Kadfak (2019) examined how rural fishers in Karnataka state, India had moved to peri-urban areas and fished as a way to manage risks.

Fish availability in Amazonia is highly seasonal because a flood pulse in the wet season strongly affects the social-ecological system, including the relative abundance and catchability of fish stocks (Junk et al., 2007; Tregidgo et al., 2020). The seasonal decline in fish catch rates causes severe seasonal food insecurity in rural areas with a four-fold increase in the likelihood of not eating for an entire day (Tregidgo et al., 2020). It is unclear whether urban fishers will likely be affected by, or respond to, seasonal variation in fishing and food insecurity in the same way.

Study aim and research questions

Our aim here is to understand the role of small-scale inland fishing in supporting the food security of urban Amazonians. In so-doing, we address important knowledge gaps around how urban fishing may contribute to livelihood strategies in the Global South. We adopt a broad definition of small-scale fishing because our experience tells us that, in Amazonia, this activity is often part of a a diverse portfolio of livelihood strategies (sensu Smith et al., 2005). Defining small-scale fishers only by stated occupation leads to under-reporting and may exclude the majority of households that fish (Nasielski et al., 2016). Likewise, using centralized urban markets to study urban fisheries (e.g., Hallwass et al., 2011) will overlook those fishing for domestic consumption, sharing in social networks or selling (some) fish *ad hoc*. We envisage that fishing may contribute to urban household food security as either a supplemental subsistence activity or primary occupation.

Our empirical study is based on a random population sample of households in four riverine Amazonian towns, with surveys conducted in the wet and dry seasons. Our research was motivated by three questions. First, is fishing associated with multi-dimensional poverty and household food insecurity? Based on work in rural fishing communities, reviewed by Béné et al. (2016), we hypothesize that urban fishers tend to be relatively poor and disadvantaged and use fishing as a strategy to cope with food insecurity whether or not it is their primary livelihood. Second, to what extent are urban fishers dependent on fish as food, considering expenditure on fish and frequency of

consumption relative to other animal-based foods? We might expect a similar pattern as found in rural fishing communities, where small-scale fishing households tend to consume more fish (Hartje et al., 2016). Third, is success at fishing associated with lower perceptions of food insecurity? For each question, we also consider whether there is seasonal variation in the outcome (fishing activity, dependency, and food insecurity).

For Q1, we compare food insecurity levels of fishers and non-fishers and then use logistic regression to see if the decision to fish is associated with household food insecurity and socio-economic covariates. For Q2, we compare the consumption frequency of different animal-based foods (including fish) between fishers and non-fishers, and evaluate local market prices of these foods. We also compare domestic fish stores and recent expenditure on fish among the two groups. For Q3, we use propensity scores matching to understand the association between fishing and food insecurity, and whether additional fish consumption among fishers is associated with variation in household food insecurity. Accordingly, we examine whether the home consumption of caught fish is associated with variation in food insecurity, *sensu* Gomna and Rana (2007) and HLPE (2014 p.36). We do not explicitly investigate the potential influence of cash income from selling fish (albeit this income would be captured in total household earnings), which is the other channel through which fishing may support food security (Hartje et al., 2018). We expect that fishing more (unmeasured) leads to higher fish consumption (measured, controlling for income), and this is associated with a reduction in food insecurity.

Materials and Methods

Study design and data collection

Our cross-sectional study was carried out in Amazonas State, Brazil. The sampling design was intended to be broadly representative of our 'universe' of interest; provincial, riverine Amazonian towns unconnected to the road network. We chose four such towns with varying accessibility to other urban centres within a hierarchical urban network (Figure 1) (Parry et al., 2018). Our definition of urban follows the official classification of urban and rural areas in each municipality; urban zoning is defined by municipal law. Although some Amazonian towns are relatively small, they provide services such as hospitals, secondary and university education, as well as private-sector services such as banks and shops. Important to our understanding of this food system is that even within towns, supermarket penetration is low, and foodstuffs are often accessed outside of market exchange (Supplementary Materials).

Data were collected during the dry season (08-to-12/2015 with approximately one month in each town), and wet season (03-to-07/2016) with a sampling target of 100 households (not revisited) per town, per season. Our final sample was 798 households (SI Table 1). The questionnaire was piloted in Manaus and a nearby small town (Autazes), then adjusted.

Households were randomly selected although we adjusted sampling density according to the number of households per census sector from the Brazilian government's 2010 population census (IBGE, 2010a). Sampling points were geolocated using Open Street Map and Google Earth, and a purchased image for Jutaí, and were restricted to the

habitable area of each city, defined as ≤20m radius of streets or river-edge. We approached the nearest household to each sample location for interview and noted the XY coordinates of all households. This research received ethical approval from Brazil's national health research ethics committee (CONEP-CNS; protocolo 45383215.5.0000.0005) and Lancaster University (S2014/126).

Our structured questionnaire included questions on socio-demographic characteristics; origin (rural/urban), number of people, age, and formal education received. Economic questions included monthly earnings (receipt of salaries, rent or other remuneration), and governmental cash transfers (e.g., state retirement pension, *Bolsa Familia* [Family Grant], *Seguro Defeso* [closed-season payments]). We asked if anyone in the household fished and, if so, how many times during the previous 30 days. We asked households on how many days during the previous 7 days had they consumed meals including fish, beef, eggs, canned meat, sausage or chicken.

We measured perceptions of food insecurity using a questionnaire modified from the Brazilian Household Food Insecurity Scale (EBIA)(Supplementary Materials). Our modified 18-point scale captures access to food and recent experiences of hunger in the household that varied from 18 (severely food insecure) to 0 (food secure). The food insecurity levels we present follow the definitions underlying the EBIA (PNAD, 2013, p. 28).

Market prices of different forms of animal protein were assessed in each town by interviewing local shop-owners or market-stall owners (6 per town per season, if all items

were available. Total of 44 surveys) using a structured questionnaire (see Davies et al., 2017).

Data Processing and Analysis

Households were classified according to recent participation in fishing, whatever the scale of the activity. Households are *fishers* if someone fished in the last 30 days and *non-fishers* if not. We bounded monetary earnings at the 98th percentile because it was highly skewed, and winsorizing prevents high-value outliers from disproportionately affecting the parameter estimate (Kerm, 2007). We assessed dietary characteristics using consumption rates of key animal-based foods.

To answer Q1 we first compared the relative food insecurity (membership of different levels and mean score) of fishers and non-fishers. We performed bivariate tests to assess socio-economic differences between the two household types, including participation in a local fishers' organization. Membership indicates being a (semi-)professional fisher. We performed a logistic regression to test how the decision to fish is associated with food insecurity and other socio-economic characteristics, enabling us to see how a unit change in a covariate relates to the odds of being a fishing household. Predictors included *food insecurity score*, number of household members (*people*), *earnings*, *cash transfers*, and *season*.

We answer Q2 using two kinds of analysis. First, we compared the consumption frequency of various animal-based foods between fisher and non-fisher households, and

performed bivariate t-tests. Related, we visually assessed the relative frequency of fish consumption (days/week). Second, we compared the market price of fresh fish with two other important food-types, beef and chicken. Finally, we compared domestic stores of fish (frozen, refrigerated or salted) and expenditure on fish (previous 7 days) between fishers and non-fishers.

To address Q3 we analyzed how fishers' perceived risks of food insecurity are associated with the frequency of fish consumption, controlling for other socio-economic characteristic variables. We assume that fish consumption (days/week) by fisher households partly reflects their success at catching fish. Given we expect the poorest and most vulnerable households use fishing as a coping mechanism we hypothesize that, when controlling for income, higher fish consumption will be associated with lower food insecurity among fishers. For non-fishers, we expect that fish consumption is not associated with variation in a household's risks of food insecurity because they purchase their fish, and it can be substituted with other foodstuffs. We ran models including; fisher and non-fisher households (models 1 and 4), non-fisher households (model 2 and 5), and fisher households (model 3 and 6).

For Q3 we employed poisson regression models and propensity score matching (PSM). Poisson regressions (models 1-3; all households, non-fishers only, and fishers only) used the total sample, with *food insecurity score* as the dependent variable and *fish.eat.days*, *people*, *earnings*, *cash transfers*, and *season* as predictors. PSM models (models 4-6, all households, non-fishers only, and fishers only) were designed to robustly assess the

relationship between fishing and the perceived risks of food insecurity (excluding *season* as a predictor; see Supplementary Materials). We interpret both Poisson model and PSM results in terms of associations rather than causal effects.

Results

Fishing to cope with poverty and food insecurity?

Fishing was common; in 40% of households someone had recently fished, from 25% in Maues to 48% in Caapiranga (SI Table 1). About 44% of households fished during the dry season compared to 36% in the wet season. Fisher households reported fishing an average of 7 days per month (wet season mean = 8 days; dry season = 6 days).

Food insecurity

Fishers were much more food insecure than non-fishers (Figure 2). Nearly a third (30.6%) of fishing households were severely food insecure, compared to 16.1% of non-fishers (SI Table 2). Moderate food insecurity was also higher among fishers (35.9%) than non-fishers (24.1%). A third of fishing households experienced mild food insecurity (25.6%) or were food secure (7.8%). In contrast, most non-fishers were either mildly food insecure (36.4%) or food secure (23.4%). Related, fishing increases along a gradient of food secure to severely food insecure (Figure 2); only 18.2% of food secure households fish, compared to most (56.0%) severely food insecure households.

Social and economic characteristics

Socio-economic characteristics (*people*, *earnings*, *cash transfers*) varied significantly different between fisher and non-fisher sub-populations (Table 1). The mean *food insecurity score* was 40% higher for fishers ($p<0.01$). Fishing households were larger (mean 5.59 people versus 4.52) and had lower monthly earnings (mean R$1,168 (USD316; mean exchange rate R$3.70: USD1, 08/2015-07/2016) than non-fishers (R$1,481; USD400). Total *cash transfers* were not significantly different between fishers and non-fishers. *Bolsa Família* payments are conditional on income poverty and number of children, and the mean was R$165 (USD45) for fisher households and R$107 (USD29) for non-fishers. *Cash transfers* were not correlated with fishing or food insecurity (SI Figure 1). Total mean monthly household income (combining earnings and cash transfers) was R$1721 (USD465) for fishers and R$2099 (USD568) for non-fishers.

A third of fisher households reported membership of their local fishers association (SI Table 3). Registered fishers in Brazil receive *Seguro Defeso*, and 11% of non-fishers were registered as fishers, indicating either opportunistic registration to claim this benefit, or that our definition of fishers (based on previous 30 days of activities) excluded some household which are involved in fishing. Most fishers were non-registered, hence their fishing activity would be for subsistence or as an occasional source of income. Summarizing, fishing households are generally more food insecure, larger, and slightly poorer than non-fishing households.

Decision to fish model

We found a strong positive, significant ($p<0.01$) relationship between food insecurity and

the probability of fishing (Table 2). An increase of 1 unit in the *food insecurity score* (relating to adopting one extra coping mechanism) is associated with 10.8% greater odds of fishing. Household size is also a significant ($p<0.01$) correlate of fishing; an extra household member is associated with 14.6% greater odds of fishing. Bigger families are more food insecure and poor, given that larger households do not have significantly higher earnings (SI Figure 1). Consequently, larger families have greater food needs, and more potential household members to go fishing. When controlling for other factors, *earnings* are apparently unrelated to fishing, whereas higher *cash transfers* are associated with reduced probability of fishing ($p<0.10$).

Finally, even when controlling for earnings and food insecurity, going fishing is 38.1% less-likely in the wet season ($p<0.01$). Overall, this analysis demonstrates that the propensity to go fishing is associated with food insecure households, larger households and the dry season.

How dependent are fishing households on eating fish?

Fisher households tended to be highly dependent on eating fish. Fishers consume fish 48% more often than non-fisher households (mean 4.4 and 3.0 days/week, respectively; Table 3), suggesting that eating caught fish is a direct benefit of fishing. The relationship between fishing and fish consumption is non-linear with a bi-modal distribution (Figure 3a). For 33.8% of fisher households, fish are consumed daily and are their principal animal-based food.

Fisher households had twice as much fish stored compared to non-fishers (mean 3.81 kg ± 0.51, versus 1.89 kg ± 0.20 SE; $p < 0.001$; Welch 2-sample t-test) and the median stores held by fishers (1.71 kg) was three-times that of non-fishers (0.50 kg). However, fishers spent much less money on fish; a weekly mean of R$10.39 ± 1.14 (USD2.81 ± 0.31) or median of R$0, versus R$21.57 ± 1.20 (USD5.83 ± 0.32) or median of R$17 (USD4.60) for non-fishers. Put differently, only 33.4% (107/320) of fisher households had spent money buying fish, versus 70.9% (339/478) of non-fisher households. Only 62 (19.4%) fishers had sold any fish in the previous 30 days, indicating that most fishing is for domestic consumption, or possibly sharing with other households. Evidently, fishing enables households access to larger quantities of fish, and urban fishers typically spend little or nothing buying fish.

Broader food practices varied significantly between fisher and non-fisher households, based on consumption of animal-based foods (Mann-Whitney-Wilcoxon tests; Table 3). Fishers more regularly consume low-quality animal foods (sausage and canned meat (Davies et al., 2017)). Conversely, fishers eat the more nutritious animal-foods less often than non-fishers (chicken on 32% fewer days; beef on 30% fewer days). Our findings suggest that fish is the principal animal-based food eaten by fisher households, which are relatively poor and food insecure. For fishers, 'fish days' are as frequent as days with either chicken, meat and eggs, combined. For non-fishers, fish consumption is only around half as frequent as chicken, meat and egg consumption, combined.

Fish prices (mean = R$6.15/kg ± 6.61 SD) were slightly lower (but more variable) than

chicken (R$7.06/kg ± 1.98 SD) and much less than beef on-the-bone (R$13.29/kg ± 4.77 SD). Non-fishers are less dependent on fish, and our findings indicate that necessity is probably why many poor urban households go fishing, and not because of relatively strong preferences for eating fish. Summarizing, fish is the most important high-quality animal-based food for both fisher and non-fishers, although fishing enables the former to eat fish more regularly, and spend less. Moreover, fisher households tend to be relatively poor, and a sizeable minority are almost entirely dependent on fish for animal-based protein and other vital nutrients.

How does fishing relate to perceptions of food insecurity?

Fisher households were significantly more food insecure than non-fishers. When controlling for other variables, fishers' risk of food insecurity is between 36.6% (model 4) and 40.0% (model 1) higher than non-fishers (Table 4). However, higher fish consumption among fishers is associated with a modest reduction in their food insecurity risks (Figure 4a) . Specifically, eating fish on one extra day per week is associated with approximately 2% lower risks (model 6 and model 4). Given that fishers eat, on average, 1.4 *extra* fish meals per week, this additional consumption may reduce their food insecurity risks only slightly – by between 2.2% (model 4) and 3.0% (model 6). If assuming a fisher catches all the fish they eat (mean 4.4 meals/week), then fishing would be associated with greater risk reductions of between 6.9% (model 4) and 9.2% (model 6). However, many fisher households eat fish daily and, for those daily-consumers catching all their own fish, we can expect larger potential reductions (-11.0% [model 4]; -

14.6% [model 6]) in these risks. Conversely, among non-fishers, fish consumption is not associated with significant changes in food insecurity, when controlling for other factors.

Earnings was associated with lower food insecurity risks for all household types ($p<0.01$). Overall, increasing monthly household income by R$100 (USD27) is associated with 4% lower food insecurity risks (models 1 and 4), with a similar effect for fishers (-3%; model 6, see Figure 4b). Fisher households catching all the fish they eat (equivalent to eating fish 19 days/month), could be reducing their food insecurity risks by an amount (9.2% using the propensity scores model) comparable to earning R$200 (USD54) more per month (8% lower risks). Our price data shows R$200 could buy 32.5 kg of fish, equating to 1.7-kg fish/day, approximately the quantity an Amazonian family would consume for a main meal, plus carbohydrates. Summarizing, fishing provides non-monetary income worth ~R$200/month for households that catch all the fish they eat.

The relationship between cash transfers and food insecurity was varied. Higher transfers were associated with lower food insecurity ($p<0.01$) for the total sample (models 1 and 4) and non-fishers (models 2 and 5). However, transfers were not linked to significant variation in food security risks of fishers (Figure 4c). This is intriguing because average transfers are not significantly different between fishers and non-fishers (Table 1). Note this is a marginal effect of transfers - controlling for family size – hence it represents the effect of *per capita* transfers. There may be complex interactions between transfers, household labour, and food insecurity, in this mostly-poor sub-population. For instance, starting to receive a retirement pension might coincide with reduced household labour, or

prompt them to reduce or stop fishing. Larger households tend to be more food insecure ($p<0.01$), although the burden of more people was lower in fisher households. When controlling for cash income, an extra person is associated with 5.7-5.8% higher food insecurity risks in fisher households (models 3 and 6; Figure 4d) compared to 10.3% to 11.7% among non-fishers (models 5 and 2).

Overall, food insecurity risks are 15.3% higher in the wet season (model 1). When controlling for income and fish consumption frequency, non-fishers experience a 23.8% wet season increase in food insecurity (model 2; $p<0.01$). In contrast, there is no significant seasonal variation in fishers' food insecurity, when controlling for income and fish meals. Moreover, fishers are relatively food insecure *throughout* the year. In the wet season, the average fisher is much more food insecure (mean score=7.4 ± 0.44 SE, median =7) than the average non-fisher (mean = 4.4 ± 0.30 SE, median =2). Fishers' food insecurity is also worse in the dry season (fishers: mean = 6.0 ± 0.37 SE, median =5; non-fishers: mean =3.5 ± 0.25 SE, median =3).

Summarizing, fishing enables poor urban households to eat more fish and may facilitate a modest reduction in their food insecurity risks. However, fishing is only partially effective in compensating for the socio-economic disadvantages experienced by these households.

Discussion

Our study's main contribution is showing that direct access to inland fisheries can

provide urban households with a way of responding to poverty and severe food insecurity. We find that fishing is widespread in small Amazonian towns and provides participating households with their main source of high-quality nutrients. Nonetheless, these urban fishers are a diverse group in terms of their dependency on fishing, linked to variation in socieconomic status, fishing practices and reasons for fishing. Overall, we find some evidence that eating more fish is associated with a modest reduction in their risks of food insecurity. Inland fisheries are considered 'invisible' resources largely ignored by policy-makers (Lynch et al., 2017) albeit the significance of inland fisheries for rural food security is increasingly recognized (Hartje et al., 2018; Youn et al., 2014). Finally, we have estimated the scale of urban fisheries in Amazonia's riverine, remote towns and cities; we argue that the voices of urban fishers must be heard in policy debates about fisheries management, urban planning, and protected areas management. Consequently, this study speaks to Lynch et al.'s (2020) call for quantitative valuation (social, economic, nutritional) of inland fisheries, and contributes to debates about the role of small-scale fisheries in supporting food security (Béné et al., 2016; Fiorella et al., 2014; Hartje et al., 2018; HLPE 2014).

Fishing as an urban livelihood of last resort?

In riverine Amazonian towns, severe food insecurity is widespread among socially-disadvantaged households, many of which turn to fishing as a coping strategy. Fishing was more likely among larger households, and those trapped in poverty or living with food insecurity. These households use fishing to draw on their labour, skills and

knowledge in order to gain non-monetary (and sometimes monetary, too) income in the form of culturally-preferred foods. Amazonia's fishery is widely accessible to the provincial urban poor because they require relatively few assets (e.g., use of a canoe), and there are vast natural resources (but see Castello et al., 2013).

The backdrop for our findings is widespread urban poverty and food insecurity (*sensu* Ruel et al., 2017). For instance, in the Amazon estuary up to 90% of people living in very poor urban neighborhoods experience some level of food insecurity (De Lima et al., 2018). Our study corroborates these results, showing that fewer than one-in-six households are food secure whereas over half suffer moderate-to-severe food insecurity. In this sense, our results resonate with research on rural contexts in the Global South which has found fishing is – in many cases - a livelihood of 'last resort', and especially important for the poorest of the poor (see Béné et al., 2016).

Fishing one-day-in-four shows that it is generally an important livelihood rather than an occasional urban activity. Hence, our study confirms that fishing and other informal activities present vital livelihood options in provincial contexts where regular, secure employment is rare and hard to access (Lowe et al., 2019; Parry et al., 2014). Given such widespread participation in *rural l*ivelihoods, Amazonia's riverine urban centres have been described as 'rural cities' (Padoch et al., 2008). Nevertheless, there are long-standing objections to the idea that fishers are inevitably from low-status, marginalized households (Béné, 2003; Smith et al., 2005). For instance, in coastal Kenya, fishers cover the whole socioeconomic spectrum and fishing as a livelihood varies between individuals

and for an individual over time (sometimes they have other alternatives)(Carter & Garaway, 2014). This variation is important; fishers in our study are not only from poor households and many will be meeting livelihood objectives beyond food security, including selling fish for income. In our study towns, such sales would occur in the municipal fish market or selling in the street, either by cargo bicycle with an ice box, or a fisher may carry their catch and walk door-to-door, for smaller amounts. Nonetheless, only 19% of fishers had sold any fish in the previous 30 days, indicating that most urban fishing relates to catching fish for domestic consumption.

Dietary dependence on fish

Urban fishers are heavily reliant on fish for dietary nutrients, and we show they are able to consume fish most days (median 4-days per week) without spending precious cash. In the Global South many rural fishers go fishing, in part, to feed their families (Belton & Thilsted, 2014; Béné, 2009), and this seems to extend to inland urban fisheries, too. As reported by Hartje et al. (2016), we found that fisher households eat fish more often than other households. This is significant because the Amazonian fishery is very diverse, including many highly nutritious species (Rocha et al., 1982). Moreover, we found that fishers also eat less of the other higher-quality animal-based foods. Non-fishers consume fish several times per week, given its affordability in the urban markets we surveyed (sensu Thilsted et al., 2016) and strong cultural preferences for fish. However, non-fishers also consumed chicken, beef as well as cheaper, less-nutritious foodstuffs (e.g., canned meat). This finding is relevant to emerging scholarship on the nutrition transition

in Amazonia towards lower-quality processed foods (Piperata et al., 2016; van Vliet et al., 2015). Heilpern et al. (2021) used modelling to explore large-scale nutrition transitions in the Peruvian Amazon, concluding that substituting inland capture fishing with chicken and farmed-fish could exacerbate iron deficiencies. Our results suggest the pace and health consequences of the nutrition transition can be softened when the urban poor have direct access to inland fisheries. It remains unclear how this finding may apply to other contexts in the Global South. Fishing livelihoods have been linked to improved food security – across income gradients – in rural Cambodia (Hartje et al., 2018) whereas, around Lake Victoria, engaging in fishing was not directly associated with fish consumption or improved food security (Fiorella et al., 2014).

Most of the provincial urban fishers we identified were non-professionals, probably fishing largely for their own consumption. For Smith (2005) this is a 'survival' strategy, in conjunction with other livelihoods. However, this merges into his 'semi-subsistence diversification' strategy because we observe that small-scale urban fishers in Amazonia may sell some surplus, trade or donate fish through their social networks. Nevertheless, many of our interviewees would not self-identify as fishers if asked their occupation (Nasielski et al., 2016; Smith et al., 2005) and our findings suggest the main way in which fishing as a livelihood is (partially) supporting urban food security is by providing a direct source of food, rather than income to buy food. Beyond this home consumption, we note that sharing and exchange of fish contributes to community connectedness in Amazonia, and supports food security in poor neighbourhoods (Lee et al., 2018) . Semi-subsistence fishers are likely overlooked when studies identify fishers through urban

markets (e.g., Hallwass et al., 2011), rather than a randomized household survey (such as ours).

Around a third of the fishers in our sample are registered (semi)-professional fishers and supply local urban markets, at least sometimes. These fishers use more specialized practices intended to increase their catch and earnings though dedicating more time and higher levels of physical capital (e.g., more ice, larger gill nets), social capital (e.g., membership of fisher associations), and human capital (e.g., skills, knowledge) (Smith et al., 2005). Of course this strategy also benefits non-fishers who buy fish in the local markets (sensu Lowe et al., 2019). In towns along the Amazon's main-stem (e.g., Jutaí), some fishing is geared towards catching catfishes (mainly *Brachyplatystoma* spp.) for export (Fabré & Barthem, 2005; Moraes et al., 2010). Given regional taboos against consuming catfishes, in these places part of the (semi)-professional urban fishers' catch will not be eaten by local people. We found that non-fishers experience greater food insecurity during the wet season than in the dry season. This could relate to seasonal changes in the prices or local availability of important foodstuffs, including fish. Our experiences show that in Maués, for example, during the wet season tambaqui (*Colossoma macropomum*) from aquaculture is one of the only fish-species consistently available, yet this 'premium' species (>R$10/kg (USD2.70)) is unaffordable to poorer households. Fabinyi et al.'s (2017) work on marine fisheries in the Philippines shows how trade is central to fully understanding the linkages between fish and food security because, for example, selling fish can enable households to buy other foodstuffs. Finally, although (semi-)professional urban fishers in Amazonia are more selective, productive,

and invest more resources than rural fishers (Hallwass et al., 2011), we question whether this also applies to (semi-)subsistence urban fishers.

Can fishing alleviate urban food insecurity?

Eating fish more often – which evidently reflects success at fishing rather than market purchases – is associated with a modest reduction in food insecurity risks among urban fishers. We estimate that fishing provides households that catch all the fish they eat with non-monetary income worth ~USD$54 per month, equivalent to ~12% of fishers' mean monetary income. If causal, this results means that fishing provides a reduction in urban food insecurity risks almost equivalent to the benefits of the conditional cash transfer, *Bolsa Família*. The precise relative potential benefits of each will depend on fishing frequency and success, and the means-tested amount a household receives in *Bolsa Família.* Nonetheless, this finding is important given the policy's modest effectiveness in reducing food insecurity in Amazonia (Piperata et al., 2016), and demonstrates that access to natural capital is an important advantage of living in a provincial remote towns. Fishing is associated with *partial* compensation for some of the structural challenges facing these marginalized urban populations; including low levels of investment, disconnect from other cities, income poverty and unemployment, and higher imported food prices (Parry et al., 2018). Accordingly, inland fisheries seemingly provide a safety net for poor, food insecure urban households. Our cross-sectional study does not allow for causal inference and we cannot rule out the possibility that – instead of providing a safety net – fisher households are poor (or food insecure) because they fish (i.e., inland

fisheries as a 'trap'). The somewhat paradoxical finding that catching and eating fish intersects with urban food insecurity mirrors a broader geographical reality. At 30-kg *per capita* annually, fish consumption in Amazonas is over four times the Brazilian average yet food security in this state is 10% lower than the national picture (IBGE, 2010b).

Seasonality in urban fishing?

More urban households go fishing in the low-water dry season, when fish in Amazonia tend to be easier to catch because they are concentrated in smaller water-bodies (i.e. fish density increases). During the wet season, rivers rise and flood into forest ecosystems and fishes disperse (i.e. fish density decreases), which research shows depresses catch-per-unit-effort (CPUE) for fishers (Batista & Petrere Júnior, 2003; Pinaya et al., 2016). Amazonia's rural fishers become more food insecure in the wet season and *increase* their fishing effort in an attempt to compensate for lower CPUE (Tregidgo et al., 2020). In the high-water wet season, we find that fishers go fishing more often and avoid worse food insecurity (when controlling for income), whereas non-fishers do not. Alternatively, urban fishers (who we show are relatively vulnerable in socioeconomic terms) may fish more during the high-water season in order to compensate for other seasonal challenges, unrelated to changes in fishing CPUE. For instance, these households may be relatively exposed to high-water season issues with transport and economic activity, other rural livelihoods, or exposure to particular infectious diseases. Landings data from the eastern Amazon also suggests that urban fishers increase fishing effort in the high-water to maintain their catch levels (Hallwass et al., 2011).

We show urban fishers are generally food insecure in both seasons, whereas non-fishers are less food insecure in the dry season. Controlling for fish consumption, fishers did not experience a significant seasonal change in food insecurity. Our experiences in Maués (see above) show that provincial urban households which depend on buying fish (i.e., non-fishers) are sensitive to local scarcity and higher prices during the wet season. Fishers' wet season food insecurity risks therefore appear to be associated with how many fish they can catch themselves (i.e. their fishing success), rather than on market prices. Nonetheless, because fishers are generally poor they are probably relatively dependent on informal employment, which is often seasonal. Hence, fisher households may still be sensitive to seasonal variation in the relative affordability of various foodstuffs.

Lower urban participation in fishing during the dry season is intriguing. Do some urban households temporarily stop fishing in the wet season because they consider it futile or unproductive, relative to other uses of their time? Further research is required to address this and other related questions on seasonality and urban fishing in Amazonia. Compared to rural fishers, perhaps they are able to substitute fish with other animal foods more easily during the wet season? Alternatively, maybe only committed, specialized urban fishers persist in the wet season, and hence the 'opportunistic' dry season-only fishers experience hunger when rivers and lakes are in flood. Certainly, many urban fisher households lack the time, knowledge or resources (e.g., large, expensive gill nets) to go further afield in search of lucrative *Colossoma macropomum*, which is normally caught

in the wet season. Regardless, we know that river-level fluctuations shape fishing practices, and influence their efficiency (Almeida et al., 2001; Mcgrath et al., 2011; Tregidgo et al., 2020). Hydrological seasonality and related consequences for fisher families and other consumers in central Amazonia may partly explain seasonal variation in prenatal growth and preterm birth odds (Chacón-Montalván et al., 2021).

Implications for future research

We hope this study motivates further research into small-scale urban fisheries in Amazonia and beyond. The nutritional dimensions of urban fishing and related fish consumption are under-researched, and our reliance on a metric of meals-containing-fish has limitations. Given social-economic and dietary changes in recent decades (Piperata et al., 2016) and inter-specific variation in fishes' nutritional composition (Hicks et al., 2019), research could develop more detailed insights into quantities and species consumed, including body parts and cooking methods. Globally, the nutritional benefits of consuming fish are well-recognized (e.g., Imhoff-Kunsch et al., 2012) but we need the evidence for developing nutrition-sensitive policies interventions. Examples include initiatives to reduce losses and develop fish drying and smoking techniques to concentrate nutrients (Thilsted et al., 2016).

Conflicts around territories and access rights are virtually ubiquitous in fisheries (e.g., Jönsson, 2019) , and it is important to understand power imbalances and vulnerabilities within Amazonia's urban fishery. Institutions determine the rights of different user groups; some fishers can be systematically excluded from decision-making processes due

to social marginalization, linked to social class and political disempowerment (Smith et al., 2005). In Amazonia, it is unclear how (semi)-subsistence urban fishers may come into conflict with either commercial fishers or rural fishing communities. Amazonia's social-ecological system is in a state of flux, including more frequent and severe floods and droughts, political instability, urban expansion, and specific changes to fisheries including territorial controls associated with nature conservation, rural development, and over-fishing (Castello et al., 2013). For example, Tregidgo et al. (2017) found severe depletion of *C. macropomum* ≤1,000km from Manaus and depletion around provincial towns yet evidence of stable multi-species catches. Work should examine the capacities of different groups of urban fishers to adapt to gradual and abrupt changes in this large, complex inland fishery (see Lowe et al., 2019).

Putting small-scale urban fisheries on the agenda

Our findings suggest there is a significant, yet largely overlooked small-scale urban fishery in Amazonia, much larger than professional fishers alone. We draw on our sample to estimate the size of the small-scale urban fishery in highly river-dependent urban centres in the Brazilian Amazon. Based on extrapolation, and adjusting for estimated 2019 population sizes (IBGE, 2019), we calculate that 84,210 households ± 10,868 SE in urban centres unconnected to the road network are fishers (Supplementary Material). Albeit many of these people would not self-identify as a fisher if asked their occupation (see above). Nonetheless, we estimate that the food security of around 470,735 urban residents in central Amazonia ± 60,753 SE may be dependent on a household member

catching fish. Members of fisher households constitute 45% ± 6 SE of the population of these riverine urban centres. The confidence intervals (SE) of our region-wide estimates are based on the lowest and highest levels of household participation in fishing from the four fieldwork towns. There is also urban-based small-scale fishing in urban centres that are partially- or fully connected the road network but we do not attempt to estimate participation in those locations.

Irrespective of the exact numbers, institutions within and beyond the state must dedicate attention and resources to these urban fisheries in order to ensure long-term, equitable access to fish stocks. Contextual challenges include helping vulnerable urban households to overcome barriers to participation, including how poor households can maintain access to the river when new public housing projects are located far from the river-edge (Parry et al., 2019). Policy-makers face the complex task of balancing the needs, right to food, and ecological impacts of Amazonia's rural, provincial urban and metropolitan populations, all of whom rely somewhat on eating fish.

Conclusions

We used household-level data from remote riverine Amazonian towns to understand the relationships between small-scale inland fishing and urban food security through the pathway of home consumption of caught fish. We found that the poorest and most food insecure households were the most likely to go fishing. Fishing typically provided participating households with monthly non-monetary income worth ≤USD54, equivalent

to around 12% of mean monetary income. These households eat more fish, diversify their diets with low-quality processed meats, and rarely consume higher-quality relatively expensive animal-based foods. Most urban fishers are non-professional and poor, and appear to use fishing as a strategy of last resort for attempting to protect against severe food insecurity. This study's main contribution is showing that many poor, food insecure households in urban Amazonia use fishing as a coping strategy and appear to be highly dependent on eating the fish they catch. Relatively high levels of fish consumption and dietary dependency by severely food insecure households show how the equitable management of, and access to, natural resources are critical to supporting food security for Amazonia's provincial urban poor. Policy-makers should therefore recognize the livelihoods dependencies of the provincial urban poor and their rights to food security and health when establishing rules and restrictions on access to fisheries.

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Data deposition

Code (in the R programming language; for data cleaning, processing, and analysis) and processed data can be provided upon reasonable request to the corresponding author.

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FIGURE CAPTIONS

Figure 1. Sampled towns within the study universe of riverine urban centres unconnected to the road network in Amazonas State, Brazil.

Figure 2. Frequency distribution of food insecurity levels among surveyed urban households. Data are separated by recent fishing activity and percentages are shown within bars.

Figure 3. Frequency distribution of surveyed urban households for (a) fish consumption, and (b) perceptions of food insecurity. Data are separated by fisher and non-fisher households and percentages are shown within bars. Vertical lines show mean consumption and food insecurity for fishers (dotted lines) and non-fishers (solid lines).

Figure 4. Modelled relationships between household characteristics and food insecurity in fisher households (model 6; propensity score matching). Blue shading indicates 95% confidence intervals. The marks along the x-axes are 'rug plots' which indicate the distribution of the data, analogous to a one-dimensional scatter plot.

Table 1. Regressor statistics: comparing fisher (n=320) and non-fisher households (n=478). Variables refer to food insecurity score (*fi.score*), members of a household (*people*), monthly household monetary *earnings*, monthly household receipt of governmental *cash transfers* and the number of days in the previous 7 days when fish was consumed (*fish.eat.days*).

fishing	variable	mean	sd	se	W	p.value
Non-fisher	fi.score	3.96	4.35	0.2	50816.5	0.0000 (***)
Fisher	fi.score	6.63	5.06	0.28		
Non-fisher	people	4.52	2.36	0.11	56809.5	0.0000 (***)
Fisher	people	5.59	2.59	0.14		
Non-fisher	earnings	1481.14	1760.55	80.53	84398.5	0.0129 (*)
Fisher	earnings	1168.33	1531.73	85.63		
Non-fisher	cash.transfers	618.77	751.4	34.37	74723.5	0.58
Fisher	cash.transfers	553.4	583.73	32.63		
Non-fisher	fish.eat.days	2.96	2.27	0.1	50836	0.0000 (***)
Fisher	fish.eat.days	4.38	2.31	0.13		

Note: * $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$

Table 2. Results from probability of fishing model (logit). Variables refer to food insecurity score (*fi.score*), members of a household (*people*), monthly household monetary *earnings*, monthly household receipt of governmental *cash transfers, and* hydrological (river-level) *season* with dry season as the reference group. The Table shows the odds ratios (log(beta)) of being a fisher, hence values >1 mean being a fisher is more likely whereas values <1 mean it is less likely. Note * p<0.1, ** p<0.05, *** p<0.01

Predictors:	*Dependent variable:* fishing
food.insecurity.score	1.108 **
	(1.0684 - 1.1476)
people	1.1463 **
	(1.0726 - 1.2201)
earnings	1
	(0.9999 - 1.0001)
cash.transfers	0.9998 ·
	(0.9995 - 1.0000)
season.wet	0.6190 **
	(0.4307 - 0.8072)
Constant	0.2959 **
	(0.1647 - 0.4272)
Observations	798
Log Likelihood	−492.8026
Akaike Inf. Crit.	997.61

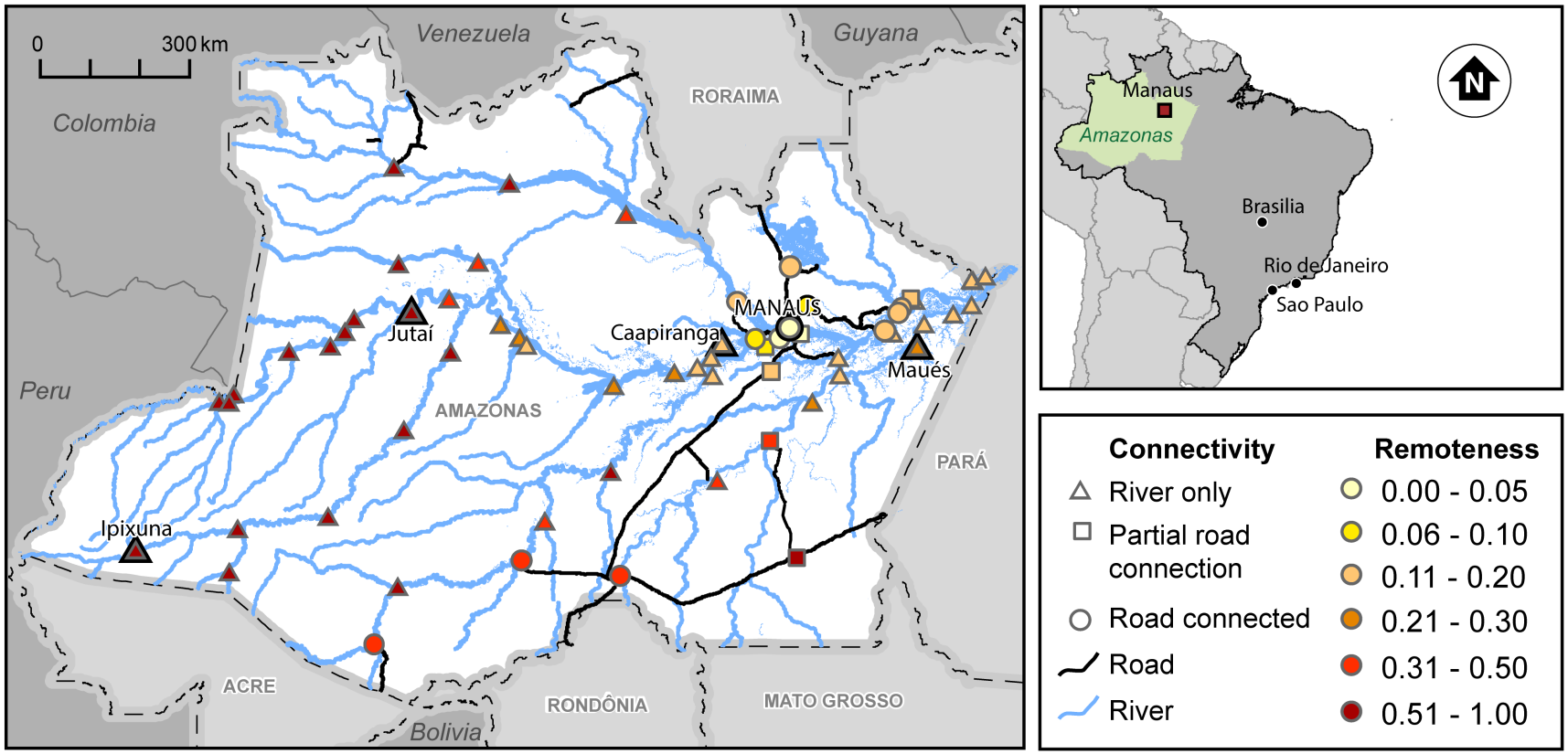
Note: · p<0.01; * p<0.05; ** p<0.01

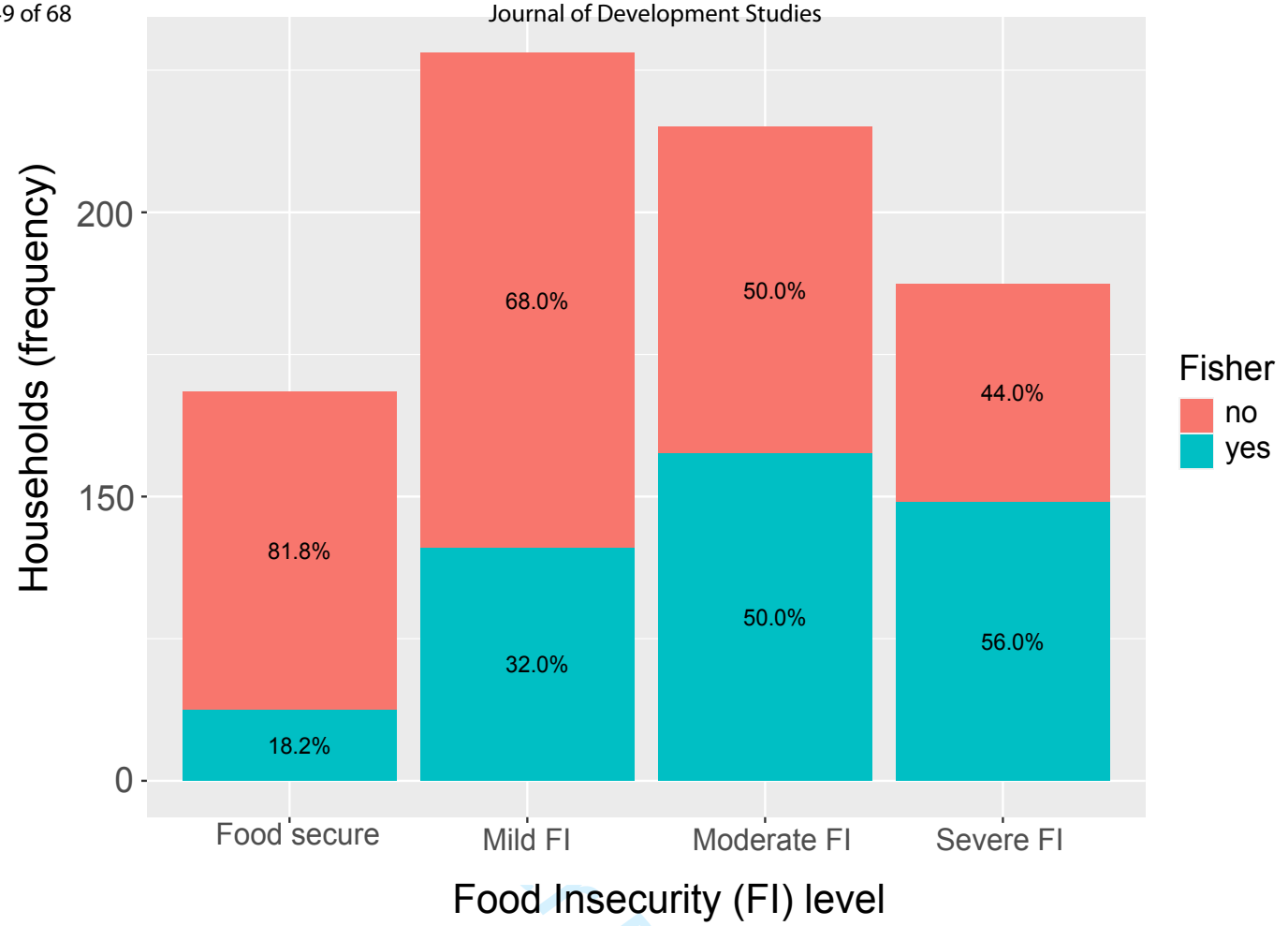
Table 3. Number of different kinds of animal-based meals consumed in the previous 7 days, separated by fisher and non-fisher households. Note: · p<0.1; * p<0.05; ** p<0.01; *** p<0.001

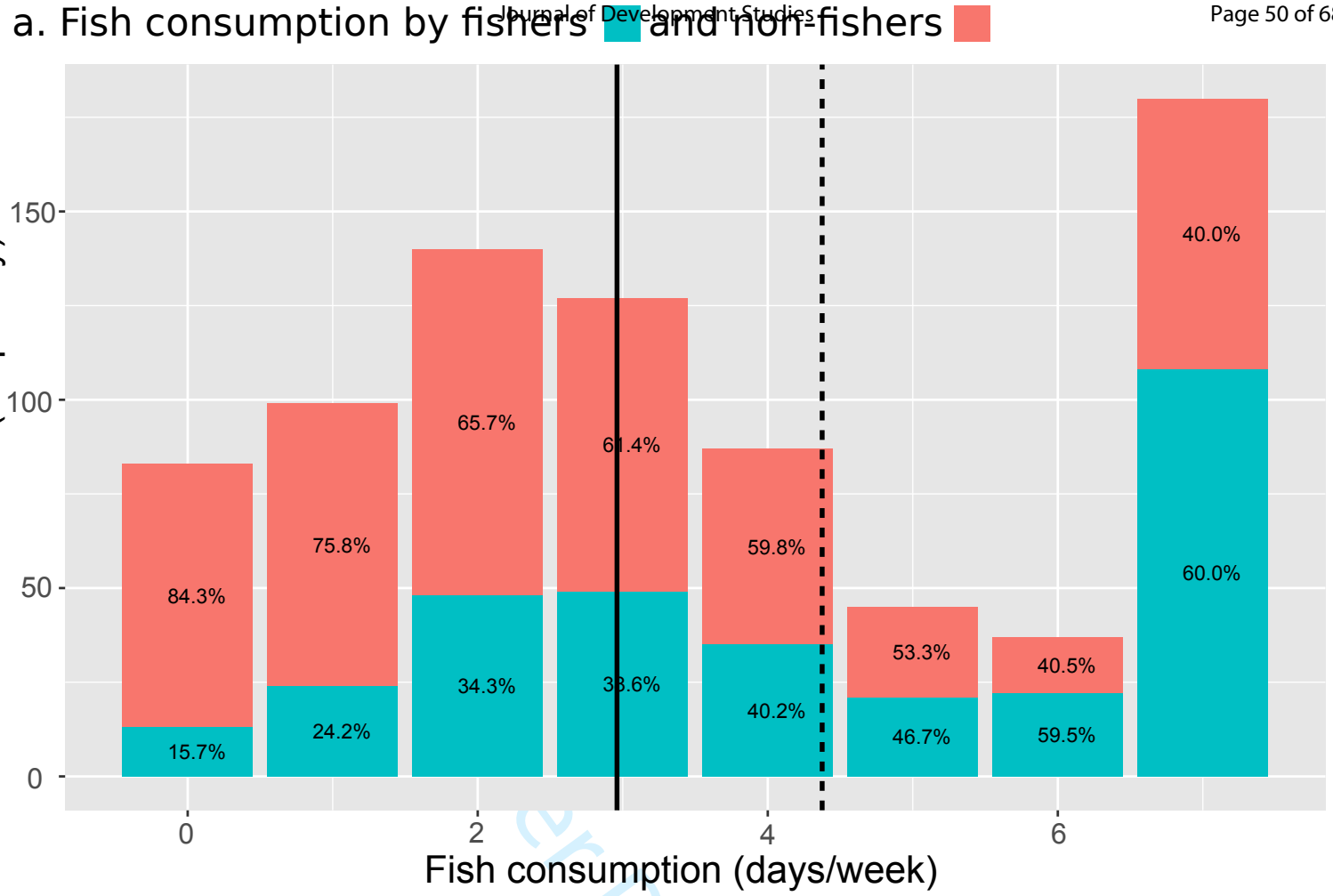
	Mean (SD)		Median			
food type	Fisher	Non-fisher	Fisher	Non-fisher	W	p.value
fish	4.38 (2.31)	2.96 (2.27)	4	3	50836	0.0000 (***)
chicken	1.60 (1.53)	2.11 (1.90)	1	2	86949.5	0.0008 (***)
meat	1.12 (1.57)	1.46 (1.61)	0	1	86603	0.0004 (***)
eggs	1.66 (1.97)	2.10 (2.20)	1	2	85025	0.0050 (**)
sausage	1.08 (1.69)	0.79 (1.42)	0	0	68755	0.0088 (**)
canned.meat	0.39 (0.85)	0.31 (0.78)	0	0	71636	0.0736 (.)

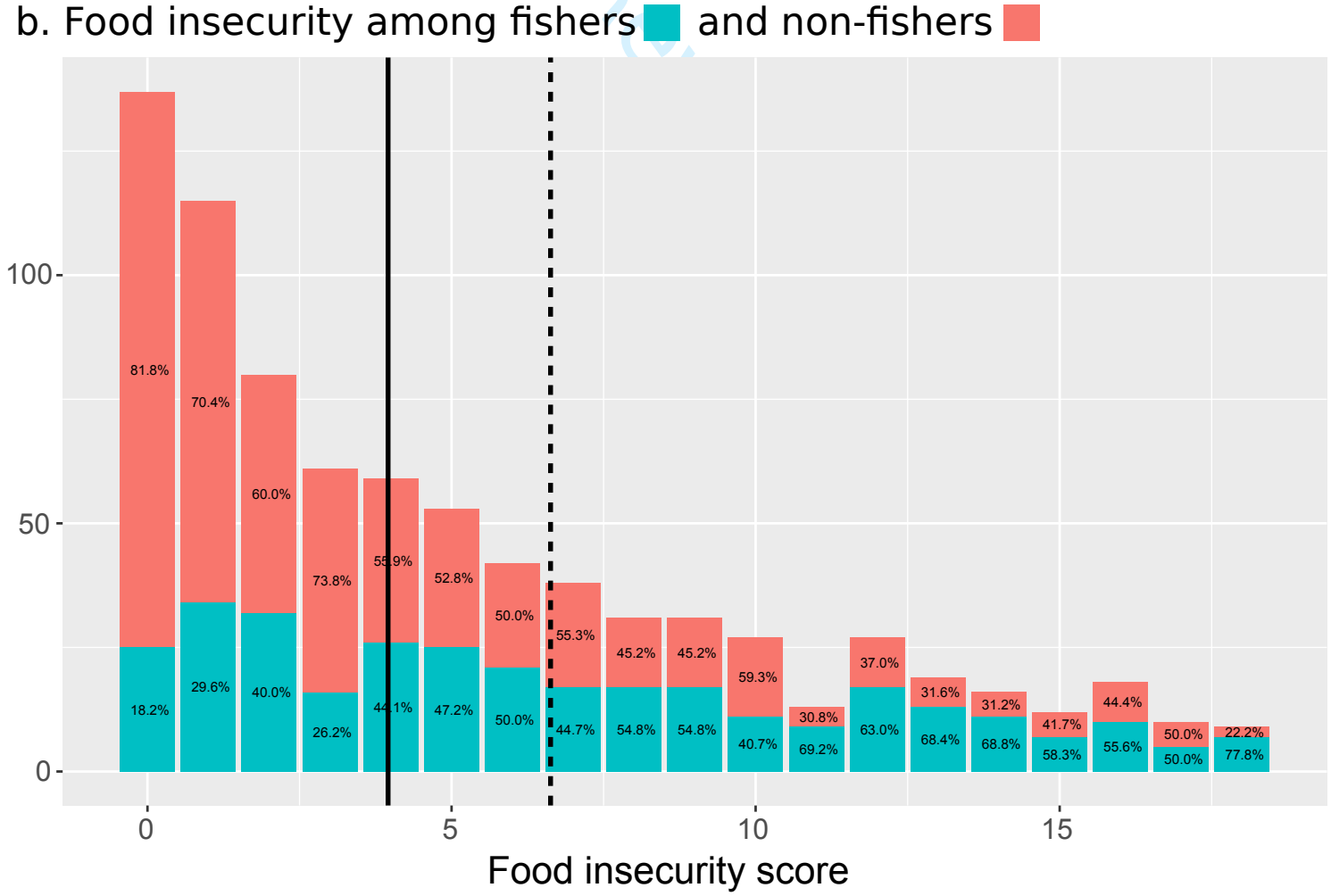
Table 4. Fishers, non-fishers and food insecurity – model results. Note: · P<0.10; *p<0.05; **p<0.01. Ps refers to propensity scores.

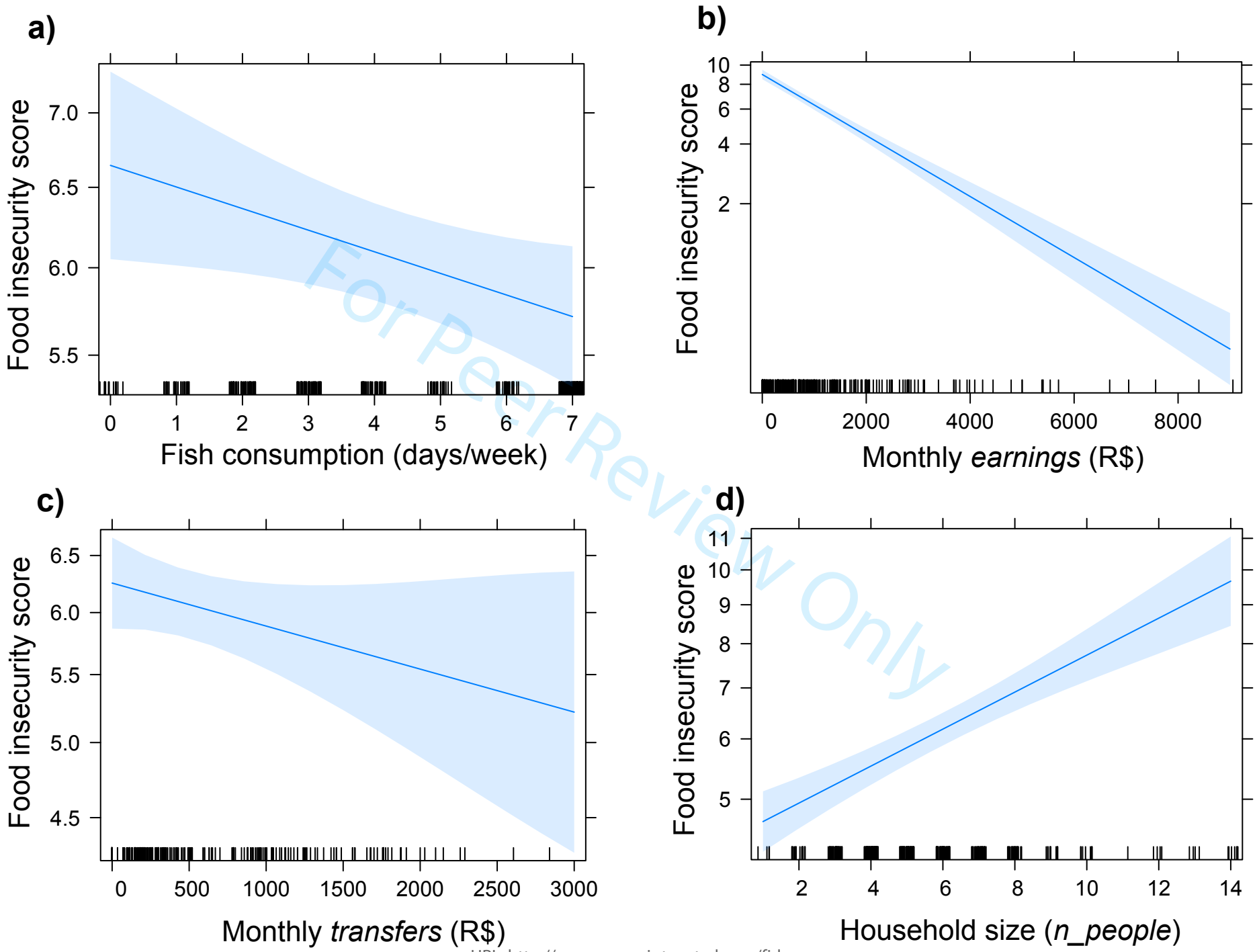
	Dependent variable: food.insecurity.score					
	urban	non fishers	fishers	(ps) urban	(ps) non fishers	(ps) fishers
	(1)	(2)	(3)	(4)	(5)	(6)
recent fishing	1.4007 **			1.3664 **		
(yes/no)	(1.3072 - 1.4941)			(1.2724 - 1.4605)		
people	1.0869 **	1.1169 **	1.0578 **	1.0729 **	1.1029 **	1.0573 **
	(1.0746 - 1.0992)	(1.0982 - 1.1355)	(1.0412 - 1.0744)	(1.0598 - 1.0859)	(1.0807 - 1.1251)	(1.0407 - 1.0739)
earnings	0.9996 **	0.9996 **	0.9997 **	0.9996 **	0.9995 **	0.9997 **
	(0.9996 - 0.9997)	(0.9995 - 0.9996)	(0.9996 - 0.9997)	(0.9996 - 0.9997)	(0.9995 - 0.9996)	(0.9996 - 0.9997)
cash.transfers	0.9998 **	0.9996 **	1	0.9998 **	0.9997 **	1
	(0.9997 - 0.9998)	(0.9995 - 0.9997)	(0.9999 - 1.0000)	(0.9998 - 0.9999)	(0.9996 - 0.9998)	(0.9999 - 1.0000)
fish.eat.days	1	1.01	0.9835 ·	0.9843 *	1	0.9792 *
	(0.9823 - 1.0099)	(0.9880 - 1.0279)	(0.9644 - 1.0026)	(0.9701 - 0.9985)	(0.9773 - 1.0236)	(0.9609 - 0.9975)
season.wet	1.1531 **	1.2378 **	1.08			
	(1.0787 - 1.2276)	(1.1212 - 1.3544)	(0.9813 - 1.1748)			
Constant	4.3422 **	3.9749 **	6.9500 **	5.2726 **	4.9432 **	7.4021 **
	(3.8991 - 4.7853)	(3.4084 - 4.5414)	(5.9120 - 7.9879)	(4.7204 - 5.8249)	(4.1099 - 5.7765)	(6.4506 - 8.3537)
Observations	798	478	320	640	320	320
Log Likelihood	−2,439.1720	−1,376.9570	−1,034.0480	−2,009.2510	−959.7351	−1,035.3940
Akaike Inf. Crit.	4892.34	2765.92	2080.1	4030.5	1929.47	2080.79


0
300 km
Venezuela
Guyana
Colombia
RORAIMA
Peru
Jutaí
MANAUS
Caapiranga
Maués
AMAZONAS
PARÁ
Ipixuna
ACRE
RONDÔNIA
MATO GROSSO
Bolivia
Manaus
Amazonas
Brasilia
Rio de Janeiro
Sao Paulo
N
Connectivity
River only
Partial road connection
Road connected
Road
River
Remoteness
0.00 - 0.05
0.06 - 0.10
0.11 - 0.20
0.21 - 0.30
0.31 - 0.50
0.51 - 1.00




a. Fish consumption by fishers and non-fishers
Households (frequency)
150
100
50
0
84.3%
15.7%
75.8%
24.2%
65.7%
34.3%
61.4%
38.6%
59.8%
40.2%
53.3%
46.7%
40.5%
59.5%
40.0%
60.0%
0
2
4
6
Fish consumption (days/week)


b. Food insecurity among fishers and non-fishers
Households (frequency)
100
50
0
81.8%
18.2%
70.4%
29.6%
60.0%
40.0%
73.8%
26.2%
55.9%
44.1%
52.8%
47.2%
50.0%
50.0%
55.3%
44.7%
45.2%
54.8%
45.2%
54.8%
59.3%
40.7%
30.8%
69.2%
37.0%
63.0%
31.6%
68.4%
31.2%
68.8%
41.7%
58.3%
44.4%
55.6%
50.0%
50.0%
22.2%
77.8%
0
5
10
15
Food insecurity score



Supplementary Information

Urban Amazonians use fishing as a strategy for coping with food insecurity

Additional information about the study context:

Of the four study towns, Caapiranga is the smallest (urban population 5,140 in 2010)(IBGE, 2010a) and least remote (0.15/1.00); 162-km travel distance from Manaus, reachable in one day. Next, Maués (0.22/1.00; population 25,832) is 343-km from Manaus (20h trip on mixed passenger-cargo boat). Jutaí (0.51/1.00; population 10,552) is 947-km from Manaus, taking ≥3 days/nights on a passenger-cargo boat or ~20h on an express passenger boat. Finally, Ipixuna (population 9,499; (score 0.66/1.00)), is 2,566-km from Manaus, taking over a month by cargo boat in the low water-season. Ipixuna is dependent on Manaus for goods and state-level services but has stronger trading links with closer urban centres in Acre State. Each town is also reachable by small airplane although this expensive mode of transport is not viable for transporting foodstuffs or most other trade goods.

In some respects these remote Amazonian towns are less urban than elsewhere in Brazil. The high transport costs and long riverine journey times to major cities stifle access to larger markets and, perhaps reinforcing the notion of these locations as 'spatial poverty traps'. The quality of public services and urban infrastucture is also often deficient. These towns fit within broader urban-rural territories (analagous to the official categorization of municipalities, each with an urban centre and rural surrounds) characterized by flows of people, goods and services, and shared histories and institutions which shape social life and the food system.

In relation to markets, although basic essentials such as cooking oil and rice may be bought from a local mini-market (often on personal credit), many urban households attempt to reduce their food expenditure through growing their own fruits and vegetables, raising poultry, hunting or fishing

(Davies et al., 2017; Parry et al., 2014). The benefits of this household production and harvesting are also shared with others – through social relations – in an 'economy of affection' (Hyden & Hydén, 1983). The non-market access to these products in Amazonia through redistribution (e.g., gifting) and reciprocity – including of fish (Lee et al., 2018) – speaks to Karl Polanyi's writings on the embeddedness of economic activity within social relations and institutions. Of course, fish can be purchased, too, typically from intermediaries in a town's municipal fish market (approximately a dozen stalls in each). Fishers or intermediaries may also sell more sporadically, from a street corner or walking or cycling around neighbourhoods. The minority of more specialized fishers with larger boats, extensive gill-nets and higher ice capacity would tend to go on more extended fishing trips and sometimes sell directly in larger urban markets, elsewhere.

Additional information about the household food insecurity scale:

The Brazilian Household Food Insecurity Scale (EBIA) was developed and validated in Brazil in 2003, building on the Household Food Security Survey Module (HFSSM) from the US Department of Agriculture (Pérez-Escamilla et al., 2004). The EBIA is somewhat similar to the widely-used Food Insecurity Access Scale (HFIAS), which also originated from the HFSSM, and was designed by USAID to be adapted for different cultural contexts (Coates et al., 2007). We asked about experiences during the previous 30 days in order to obtain seasonally precise food insecurity measures, consistent with our sampling of peak wet and dry seasons. This contrasts with the EBIA norm of three months, instead aligning with the HFIAS. We will under-estimate the occurrence of EBIA coping mechanisms relative to conventional studies using a three month time-frame. Unlike the HFIAS, we did not ask 'frequency-of-occurence' questions, because this would lengthen interview duration. Our scale included 13 of 14 questions in the EBIA-14 (Segall-Corrêa et al., 2014), excluding "*did household members run out of money to have a healthy and varied diet?*" because our pilot work showed 'healthy' and 'varied' were not well understood in our study context, which appeared to embarrass interviewees. We also added five questions to include food

access strategies and coping mechanisms in Amazonia, which our pilot work showed to indicate severe food insecurity. These included doing the following, *through necessity*: eating a meal with only toasted manioc flour; borrowing money or buying food on credit; borrowing food from another family; having a meal in someone else's home; reducing quantity of meat or fish in a meal. See the questionnaire in Appendix and Chacon-Montalvan et al. (in final revision) for more validation details.

Relating to food insecurity levels (i.e. categories based on the *food.insecurity.score*); severe food insecurity means going hungry, or not eating for an entire day due to lacking food or resources. Mild food insecurity reflects anxiety about running out of food. Increasing severity indicates reduction of portion sizes (moderate) or skipping meals (moderate-to-severe). Accordingly, we classified households by the number of related questions to which they responded 'yes', controlling for whether there were children in the household or not.

Additional information on propensity scores matching

This approach seeks to equalize groups (fishers and non-fishers) in a sample in order to reduce the effects of variation in other characteristics (D'Agostino, 1998), and therefore obtain an average treatment effect from observational data. PSM attempts to approximate a random trial in order to match controls with experimental subjects. Using matching methods to mimic randomization is gaining popularity in the social sciences (Stuart, 2010) and is relevant here given the different socio-economic characteristics of fisher and non-fisher households, which could bias results. PSM more robustly estimates (relative to possion regressions) how fishing may be associated with food insecurity by adjusting for observed potential confounders; *people, earnings, cash transfers*, and *fish.eat.days*. *Season* was excluded from PSM analyses because the introduction of this binary variable would half the effective sample size available for testing the main (binary) variable of interest; being a *fisher* household, or not. So, with recent fishing as the 'treatment', we replicated

the Poisson regressions with these matched sub-populations. If there are significant differences in the effect of *fish.eat.days* on food insecurity between matched fishers and non-fishers, we can be more confident of an exposure effect. However, whether or not PSM allows for making causal inferences is controversial, especially due to the assumption of no unobserved confounders.

Descriptive statistics

The *food insecurity score* is negatively correlated with *earnings* (SI Figure 1; r = -0.37, p<0.01). Fisher households have significantly lower *earnings* (r = -0.09, p < 0.05) and greater food insecurity (r = 0.27, p < 0.01) than non-fishers, and consume fish more often (*fish.eat.days* r = 0.29, p < 0.01). Larger households (*people*) are more likely to go fishing (r = 0.21, p < 0.01). Number of *people* is also modestly, positively correlated with *fish.eat.days* and *cash transfers* (Table 1).

Estimating fishers in urban centres unconnected to the road network

68 road-less urban centres identified by Parry et al. (2018) in six Amazonian states (Amazonas, Pará, Amapá, Roraima, Acre, Rondônia). Our analysis of IBGE (2019) data shows the population of road-less municipalities (urban and rural combined) grew, on average, by 15.4% from 2010 to 2019. Assuming rural-urban populations grew at the same rate, we estimate the total urban population in 2019 was 1,055,236 people. We calculate there were 209,999 households in these urban areas in 2019, using mean household size in 2010 (5.02 people). We estimate urban fisher households using variance in fishing participation in our four study towns, and then calculate the population in urban fisher households using our data (mean = 5.59 people).

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Stuart, E. A. (2010). Matching methods for causal inference: A review and a look forward. *Statistical Science : A Review Journal of the Institute of Mathematical Statistics*, *25*(1), 1–21.

SI Table 1. Frequency of fisher and non-fisher households (previous 30 days) by town

Municipality	Fishers	Non-fishers	Proportion (fishing)
Ipixuna	90	110	0.45
Jutai	84	117	0.42
Caapiranga	96	102	0.48
Maues	50	149	0.25
Total	320	478	0.40

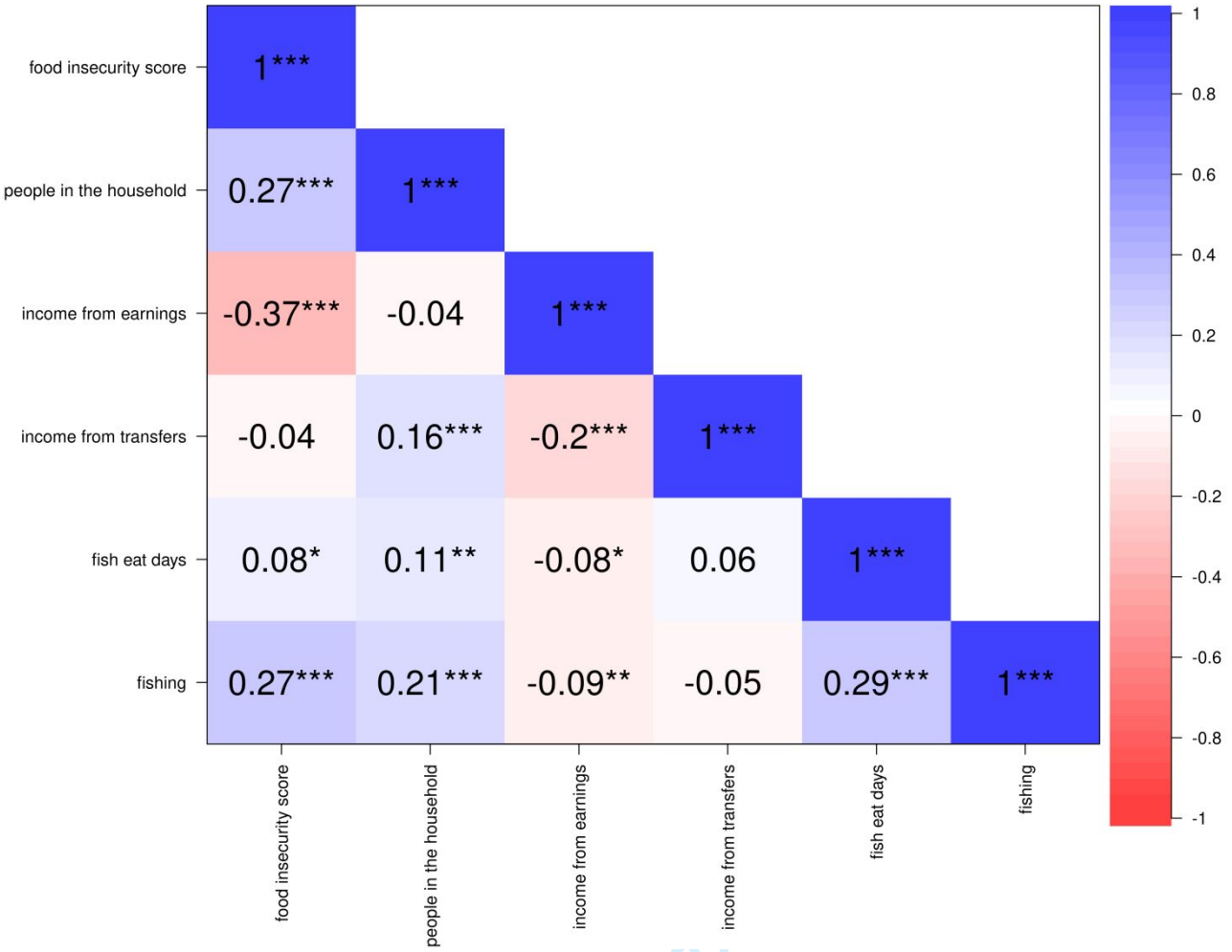
SI Table 2. Levels of food insecurity among fisher and non-fisher households

Level	Fishers		Non-fishers		Total	
	N	%	N	%	N	%
Secure	25	7.8	112	23.4	137	17.2
Mild	82	25.6	174	36.4	256	32.1
Moderate	115	35.9	115	24.1	230	28.8
Severe	98	30.6	77	16.1	175	21.9

SI Table 3. Household participation in local fishers associations, and recent fishing activity (previous 30 days)

Registered	Fishers		Non-fishers		Total		Proportion (fishing)
	N	%	N	%	N	%	
yes	107	33.4	54	11.3	161	20.2	0.66
no	213	66.6	424	88.7	637	79.8	0.33

SI Figure 1. Correlations between the regressors.


food insecurity score
people in the household
income from earnings
income from transfers
fish eat days
fishing
1***
0.27***
1***
-0.37***
-0.04
1***
-0.04
0.16***
-0.2***
1***
0.08*
0.11**
-0.08*
0.06
1***
0.27***
0.21***
-0.09**
-0.05
0.29***
1***
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1

DOMICÍLIO	Data de entrevista: ____/____/_____ Início: ____:____ Término: ____:____	1
	Entrevistador:	
ENTREVISTA CHEFE DO DOMICÍLIO – Zona Urbana	Registro da UD |__| |__| |__||__||__|	

IDENTIFICAÇÃO

Município		**Coordenadas do domicílio:**
Bairro/comunidade		Ponto GPS |__| |__||__||__|

I - DEMOGRAFIA DA UNIDADE DOMÉSTICA

1. Para começar, gostaria que o/a senhor(a) identificasse todas as pessoas que moram nesta casa, mesmo que morem só parte do ano ou parte do mês (como, por exemplo, alguém que mora uma parte do tempo no sítio/interior). Por favor, me diga que tipo de parentesco ou a relação que essa pessoa tem com o/a senhor(a), sua idade, estudo e se estão morando aqui nesta casa agora *(incluir o entrevistado na lista)*.

	1.1	**1.2**	**1.3**	**1.4**	**1.5.**		**1.6**
	Qual é o primeiro nome de cada uma das pessoas que moram aqui?	Qual é a relação dele(a) com o/a senhor(a)? (*código*)	Sexo *m=masculino f=feminino*	Quantos anos ou meses completos ele/ela tem?	Qual série ele/ela terminou até agora? *Colocar ano e grau* ***só para quem tem 15 anos ou mais.***		Esta pessoa está morando nesta casa no momento? *1=sim 2= não – outra cidade 3 = não - zona rural*
					ANO	NÍVEL (f=fundamen., m= médio, s=superior)	
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							

Códigos 1.2: ***1****=entrevistado;* ***2****=esposa(o);* ***3****=filho(a);* ***4****=cunhado(a);* ***5****=neto(a);* ***6****=mãe/pai;* ***7****=sogro(a);* ***8****=avô(ó);* ***9****=irmão/irmã;* ***10****=genro/nora;* ***11****=tio/tia;* ***12****=sobrinho(a);* ***13****=padrasto/madrasta;* ***14****=afilhado(a);* ***15****=padrinho/madrinha;* ***16****=primo(a);* ***17****= filho/filha de criação;* ***18****=compadre/comadre;* ***19****=amigo(a);* ***20****= nenhuma das anteriores- anotar o que é.*

1.7. Nos **últimos 30 dias**, ou seja, desde o dia _____ do mês passado até hoje, vocês tiveram algum hóspede nesta casa? |__| SIM |__| NÃO - *Se **NÃO** - Pular para **1.8***

1.7.1. Quantas pessoas vocês tiveram de hóspede nos últimos 30 dias? _____

1.7.2. De onde cada hóspede veio? **Hóspede 1**: município: _____ |__| zona rural |__| zona urbana

Hóspede 2: município: _____ |__| zona rural |__| zona urbana

Hóspede 3: município: _____ |__| zona rural |__| zona urbana

1.7.3. Por qual motivo cada hóspede veio visitar vocês? **Hóspede 1**: _____

Hóspede 2: _____

Hóspede 3: _____

1.7.4. Quanto tempo cada hóspede ficou? **Hóspede 1**: _____

Hóspede 2: _____

Hóspede 3: _____

1.8. Há quanto tempo o(a) senhor(a) mora aqui nessa cidade, no total?|__||__|anos |__||__|meses ou |__|sempre morou

1.9. E seu(a) esposo(a)? |__||__| anos ou |__| sempre morou nesta cidade *ou* |__| *não se aplica*

1.10. O(a) senhor(a) morava na zona rural logo antes de vir para cá? |__| SIM – neste município |__| SIM – outro munícipio |__| NÃO *ou* |__| *não se aplica*

1.11. E seu(a) esposo(a)? |__| SIM – neste município |__| SIM – outro município |__| NÃO *ou* |__| *não se aplica*

1.12. Há quanto tempo vocês moram aqui nesta casa? |__||__| anos |__||__| meses

1.13. Agora vou falar 5 atividades e gostaria de saber **quantas dessas 5** alguém da casa faz (pode ser pessoas diferentes para cada atividade, mas queremos saber quantas no total), mesmo que de vez em quando não o ano todo:

Pesca - agricultura - caça - comércio - professor R (0-5): _____

Comentários módulo I:

II – LIGAÇÕES ZONA URBANA – ZONA RURAL

2.1. Vocês têm quintal ou outro terreno aqui na cidade com produção? |__| SIM |__| NÃO -- ***Ir para 2.1.b***

2.1.1. A produção é para consumo, venda ou para os dois? |__|consumo |__| venda |__| consumo e venda

2.1.2. A produção é na várzea, terra firme ou nos dois? |__| várzea |__| terra firme |__| várzea e terra firme

2.1.b. Já perdeu pelo menos parte da produção em uma seca ou cheia? |__|SIM – seca |__|SIM - cheia |__|NÃO

2.2. Alguém aqui desta casa vai, pelo menos às vezes, para a zona rural/interior? |__| SIM |__| NÃO **-- *Ir para 2.3***

2.2.1. Com que frequência vai para o lugar mais visitado? |__| 1 vez ao ano |__| 2 vezes ao ano |__| 3-6 vezes por ano |__| 1 vez por mês |__| 2 vezes por mês |__| 1 vez por semana |__| mais de 1 vez por semana

2.2.2. Quantos dias passa no lugar a cada vez? |__| menos de 1 dia |__||__| dias |__| varia muito

2.2.3. O lugar visitado fica na beira de um: |__|rio |__|lago |__|estrada |__|trilha |__|outro_____

2.2.4. Por onde chega a esse lugar? (***marcar todos que aplica***) **Na seca:** |__|rio |__|igarapé |__|estrada |__| trilha **Na cheia:** |__| rio |__| igarapé |__| estrada |__| trilha

2.2.5. Qual é o nome da localidade e do rio, lago, estrada onde a localidade fica? Localidade: _____ _____ Rio, lago ou estrada: _____

2.2.6. Vocês têm casa própria neste lugar? |__| SIM |__| NÃO

2.2.7. Em qual mês e ano foi a última vez que alguém de casa foi para esse lugar? |__||__|/20|__||__|

2.2.8. Nos **últimos 30 dias,** ou seja, desde o dia ___ do mês passado até hoje, quantos dias alguém ficou lá? |__||__|

2.2.9. Quais atividades fazem lá? (***marcar todas que aplica***) |__| visitar parente |__| visitar colegas |__| atividade religiosa |__| lazer |__| agricultura-consumo |__| agricultura-venda |__| pescar-consumo |__| pescar-venda |__| caçar |__| extrativismo-consumo |__| extrativismo-venda |__| esporte |__| outro _____

2.2.10. Já aconteceu de não conseguir chegar nesse lugar por causa da seca ou da cheia? |__| nunca aconteceu |__| aconteceu na seca |__| aconteceu na cheia

2.2.11. Já aconteceu de uma seca ou cheia atrapalhar de conseguir alimento para a família ou dinheiro?

|__| SIM – na seca |__| SIM – na cheia |__| NÃO

Se tem algum tipo de produção:

2.2.12. A produção é na várzea, terra firme ou nos dois? |__| várzea |__| terra firme |__| várzea e terra firme

2.3. Já perdeu pelo menos parte de alguma produção em uma seca ou cheia? |__|SIM – seca |__|SIM - cheia |__|NÃO

Comentários módulo II:

III – CAPITAL SOCIAL

Apenas o entrevistado principal deve responder a esse módulo do questionário

3. Agora vou perguntar ao(à) senhor(a) algumas coisas sobre o bairro e algumas atividades que vocês podem ter.

3.1. Você ou outra pessoa desta casa participa de alguma dessas associações, sindicato ou grupo de pessoas (pode ser por exemplo da igreja ou cultural)?

	3.1.1. Participa ***0=não 1=sim***	**3.1.2.** Nome da associação, sindicato ou grupo
Colônia de pescadores		
Sindicato dos trabalhadores rurais		
Associação ou outro sindicato profissional		
Associação de bairro		
Frequenta igreja (pelo menos 1 vez por mês)		
Grupo da igreja		
Grupo de esporte/time		
ONG		
Associação de pais de alunos		
Partido político (militante)		
Outro		

3.2. De uma forma geral, quanto você concorda ou discorda das seguintes frases, sendo que 5 é se você concorda muito e 1 se você discorda muito? ***Mostrar a escala para o entrevistado e anotar o número nos quadrados ao lado das frases.***

a. A maioria das pessoas do bairro são confiáveis. |__|

b. A maioria das pessoas do bairro te ajudariam se você precisasse. |__|

3.3. Agora gostaria de saber o quanto você confia em diferentes pessoas, sendo que 5 é se você confia muito e 1 se você não confia nada. ***Mostrar a escala para o entrevistado e anotar o número nos quadrados ao lado das frases.***

A. Donos de mercadinho/taberna |__| / B. Médicos e enfermeiros |__| / C. Outros funcionários da prefeitura |__| / D. Polícia |__| E. Vereadores |__| F. Professores |__| / G. Amigos |__| / H. Estranhos |__|

3.4. Nos últimos 12 meses, ou seja, desde _____ (*mês*) do ano passado até hoje, alguém que mora aqui nesta casa participou de algum mutirão de bairro? |__| SIM |__| NÃO – ***Ir para 3.5***

3.4.1. Quantas vezes? |__||__| |__| não sabe

3.5. Quantas vezes alguém da casa usa a internet na semana? |__| todo dia |__| algumas vezes por semana |__| uma vez por semana |__| menos de uma vez por semana |__| nunca usa |__| não sabe

3.6. Quantas vezes alguém da casa ouve rádio na semana? |__| todo dia |__| algumas vezes por semana |__| uma vez por semana |__| menos de uma vez por semana |__| nunca ouve |__| não sabe

3.7. Quão seguro(a) você se sente andando à noite sozinho(a) na sua rua? Sendo que 5 é se você se sente muito seguro(a) e 1 não se sinta nada seguro(a). ***Mostrar a escala para o entrevistado e anotar o número no quadrado*** |__|

3.8. Você acha que os moradores do seu bairro são unidos? Sendo que 5 é se você acha muito unidos e 1 se acha muito desunidos. ***Mostrar a escala para o entrevistado e anotar o número no quadrado*** |__|

3.9. Você acha que a prefeitura ouve o que você e as pessoas como você pedem e sugerem? Sendo que 5 é se você acha que eles ouvem bastante e 1 se você acha que eles não ouvem nem um pouco? ***Mostrar a escala para o entrevistado e anotar o número no quadrado.*** |__|

3.10. Você acha que você e pessoas que vivem em condições iguais as suas podem mudar algo no seu bairro? Sendo que 5 é se você acha que podem facilmente promover mudanças e 1 se você acha que não podem ***Mostrar a escala para o entrevistado e anotar o número no quadrado.*** |__|

3.11. Quem você acha que vai contribuir mais para mudar alguma coisa na sua vida? (***Não ler as opções)*** |__|você mesma |__| sua família |__| a prefeitura |__| o governo do estado |__| o governo federal |__| outro_____

Comentários módulo III:

IV – RENDA E RIQUEZA

Agora vou perguntar sobre alguns tipos de pagamento que vocês podem receber do governo ou de alguém.

4.1. Alguém aqui desta casa recebeu nos **ÚLTIMOS 30 DIAS**:

- ☐ Bolsa Família: número de mães |__||__| R$ _____
- ☐ Aposentadoria: número de pessoas |__||__| R$ _____
- ☐ Aposentadoria por invalidez: número de pessoas |__||__| R$ _____
- ☐ Pensão: número de pessoas |__||__| R$ _____
- ☐ Seguro defeso: número de pessoas |__||__| R$ _____
- ☐ Seguro desemprego: número de pessoas |__||__| R$ _____
- ☐ Salário maternidade: número de pessoas |__||__| R$ _____
- ☐ Bolsa floresta: número de pessoas |__||__| R$ _____
- ☐ Auxílio enchente: R$ _____
- ☐ Aluguel: R$ _____
- ☐ Remessa de parentes: R$ _____
- ☐ Outro _____ número de pessoas |__||__| R$ _____

4.2. Agora gostaria de saber sobre as atividades que dão renda, que o(a) senhor(a) e os outros moradores desta casa podem ter realizado nos **ÚLTIMOS 30 DIAS**:

- ☐ Emprego regular: n. de pessoas|__||__| R$ _____(líquido) |__|**carteira assinada** |__|**concurso** |__|**contrato**
- ☐ Emprego temporário: n. de pessoas|__||__| R$ _____(líquido) |__|**carteira assinada** |__|**concurso** |__|**contrato**
- ☐ Diária: número de pessoas |__||__| número de diárias |__||__| preço por diária |__||__|

Total R$ _____ Qual tipo de trabalho: _____, _____, _____

☐ Empreita: número de pessoas |__||__| número de empreitas |__||__| preço por diária |__||__|

Total R$ _____ Qual tipo de trabalho: _____, _____, _____

☐ Venda de produto agrícola: número de pessoas |__||__| bruta R$ _____

☐ Venda de açaí: número de pessoas |__||__| líquida R$ _____ bruta R$ _____

☐ Venda de peixe: número de pessoas |__||__| líquida R$ _____ bruta R$ _____

☐ Outro tipo de comércio: número de pessoas |__||__| líquida R$ _____ bruta R$ _____

☐ Outros:_____ número de pessoas|__||__| líquida R$ _____ bruta R$ _____

4.3. Agora vou perguntar sobre alguns bens que vocês, aqui desta casa, podem ter. Vocês têm:

Freezer |__| NÃO |__| SIM Quantos? |__||__| Geladeira |__| NÃO |__| SIM Quantos? |__||__|

Moto |__| NÃO |__| SIM Quantos? |__||__| Carro ou caminhonete |__| NÃO |__| SIM Quantos? |__||__|

Canoa com rabeta |__| NÃO |__| SIM Quantos? |__||__| Voadeira |__| NÃO |__| SIM Quantos? |__||__|

Barco de motor |__| NÃO |__| SIM Quantos? |__||__| Antena parabólica |__|NÃO |__| SIM Quantos? |__||__|

Comentários módulo IV:

V – ACESSO DE ALIMENTOS

5.1. Qual a frequência com que vocês costumam comprar alimentos? |__| todos os dias |__| 2-6 vezes por semana |__| 1 vez por semana |__| 2-3 vezes por mês |__| uma vez por mês |__| menos que uma vez por mês

5.1.1. Quantos desses 5 diferentes tipos de carne foram consumidos aqui na casa nos últimos 30 dias?

Carne de boi - frango congelado - peixe - carne de caça - pato R (0-5): _____

Agora vou perguntar sobre alguns alimentos que vocês podem ter em casa agora.

5.2.		**5.2.1**	**5.2.2**		**5.2.3.**	**5.2.4.**
Código	**Tipo de alimento**	Vocês têm em casa? 0=NÃO 1=SIM	Quanto vocês têm deste alimento agora aqui nesta casa?	UNID	Nos últimos 7 dias, em quantos dias vocês comeram diferentes tipos de carne e ovo?	Nos últimos 7 dias, quantos reais vocês gastaram comprando diferentes tipos de carne e ovo?
	Arroz					
	Feijão					
	Farinha de mandioca/macaxeira					
	Leite					
	Açúcar					
	Óleo vegetal					
	Ovos de galinha					
	Frango congelado					
	Salsicha					
	Carne de boi fresca/congelada					
	Carne enlatada/conserva					
	Peixe – qual?					
	Peixe – qual?					
	Peixe – qual?					

5.3. Como vocês conseguiram a farinha que vocês estão comendo em casa no momento? *(|__| não tem farinha em casa)*

|__| Comprou |__| Ganhou |__| Trocou |__| Produziu

5.4. Vamos perguntar sobre as frutas que vocês comeram aqui nesta casa nos últimos 3 dias. Comeram: |__| nenhuma |__|banana |__|mamão |__|manga |__|açaí |__|outra _____ |__|outra_____ |__|outra_____ |__|outra_____ |__|outra_____ |__|outra_____

5.5. Vocês têm criação de galinha nesta casa? |__| SIM |__| NÃO – ***Ir para 5.6***.

5.5.1. Quantos frangos ou galinhas adultas (sem contar os pintinhos) vocês estão criando no momento? |__||__|

5.6. Vocês aqui desta casa têm conta, ou seja, podem comprar fiado quando quiserem, em alguma taberna, mercadinho, supermercado ou com algum vendedor de comida? |__| SIM |__| NÃO |__| NÃO pois eles têm taberna/mercadinho/é vendedor – ***Ir pra a pergunta 5.7***

5.6.1. Hoje, quanto vocês estão devendo no total (incluindo todos os lugares)? R$_____

5.6.2. Nos últimos 12 meses, ou seja, desde o mês de _____ do ano passado até hoje, alguma vez vocês atrasaram ou tiveram dificuldade para pagar essa conta? |__| NÃO |__| SIM

5.6.3. Vocês abateram a dívida com algum produto que colheram/pescaram ou com trabalho? |__| SIM |__| NÃO

5.7. Alguém aqui desta casa tem cartão de crédito? |__| SIM |__| NÃO **– *Ir para 6.1***

5.7.1. O cartão de crédito é usado para comprar refeição ou gêneros alimentícios? |__| refeição (almoço, janta) |__| gêneros alimentícios |__| NÃO

Comentários módulo V:

VI – CONSUMO DE CARNE SILVESTRE

6.1. Quais dessas espécies já foram consumidas aqui no domicílio e quando foi a última vez:

Anta |__|*não quis responder* |__| não |__| sim Quando (*pelo menos o mês e o ano*) |__||__|/|__||__|/|__||__|

Queixada |__|*não quis responder* |__| não |__| sim Quando (*pelo menos o mês e o ano*) |__||__|/|__||__|/|__||__|

Paca |__|*não quis responder* |__| não |__| sim Quando (*pelo menos o mês e o ano*) |__||__|/|__||__|/|__||__|

Cutia |__|*não quis responder* |__| não |__| sim Quando (*pelo menos o mês e o ano*) |__||__|/|__||__|/|__||__|

Mutum espécie:_____ |__| não quis responder |__| não |__| sim Quando (*pelo menos o mês e o ano*) |__||__|/|__||__|/|__||__|

Tracajá |__|*não quis responder* |__| não |__| sim Quando (*pelo menos o mês e o ano*) |__||__|/|__||__|/|__||__|

Jacaré sp _____ |__| não quis responder |__| não |__| sim Quando (*pelo menos o mês e o ano*) |__||__|/|__||__|/|__||__|

Pirarucu |__|*não quis responder* |__| não |__| sim Quando (*pelo menos o mês e o ano*) |__||__|/|__||__|/|__||__|

Surubim |__|*não quis responder* |__| não |__| sim Quando (*pelo menos o mês e o ano*) |__||__|/|__||__|/|__||__|

Pirarara |__|*não quis responder* |__| não |__| sim Quando (*pelo menos o mês e o ano*) |__||__|/|__||__|/|__||__|

Barrigudo |__|*não quis responder* |__| não |__| sim Quando (*pelo menos o mês e o ano*) |__||__|/|__||__|/|__||__|

Guariba/capelão |__|*não quis responder* |__|não |__|sim Quando (*pelo menos o mês e ano*) |__||__|/|__||__|/|__||__|

Peixe-boi |__|*não quis responder* |__|não |__|sim Quando (*pelo menos o mês e o ano*) |__||__|/|__||__|/|__||__|

Jabuti |__|*não quis responder* |__|não |__|sim Quando (*pelo menos o mês e o ano*) |__||__|/|__||__|/|__||__|

6.1.1. Agora gostaria de saber se o(a) senhor(a) acha que desde 5 anos atrás até agora está mais difícil, mais fácil ou não mudou conseguir os bichos que vou falar agora aqui no município:

Paca |__|*não quis responder* |__| mais difícil |__| não mudou |__| mais fácil |__| não sabe/não come

Anta |__|*não quis responder* |__| mais difícil |__| não mudou |__| mais fácil |__| não sabe/não come

Jabuti |__|*não quis responder* |__| mais difícil |__| não mudou |__| mais fácil |__| não sabe/não come

Peixe-boi |__|*não quis responder* |__| mais difícil |__| não mudou |__| mais fácil |__| não sabe/não come

Tracajá |__|*não quis responder* |__| mais difícil |__| não mudou |__| mais fácil |__| não sabe/não come

6.2.1. Em quantas refeições vocês consumiram carne de caça nos últimos 7 dias, ou seja, desde _____ da semana passada até hoje, aqui na casa? |__||__| vezes

6.2. Em quantas refeições vocês consumiram carne de caça nos últimos 30 dias, ou seja, desde o dia _____ do mês passado até hoje, aqui na casa? |__||__| vezes

6.2.2. Quais tipos de bichos de caça vocês comeram aqui na casa nesses últimos 30 dias? (*Se porco, tatu, veado - perguntar qual espécie/tipo*) - 1. _____, 2. _____, 3._____, 4._____, 5._____, 6._____, 7._____, 8._____, 9._____, 10._____

6.3. Quando foi **a última vez** que vocês consumiram caça no domicílio? *Se não souber o dia perguntar se foi no começo, meio ou fim do mês – se for começo colocar dia 1, se foi no meio colocar dia 15 e se foi no fim colocar dia 30.*

|__| nunca comeram Data (*pelo menos o mês e o ano*): |__||__|/|__||__|/|__||__|

6.3.1. Qual(is) bicho(s) comeram da última vez? _____, _____, _____

6.3.2. Como vocês conseguiram a caça **nessa última vez**? |__|ganharam |__| compraram |__|caçaram

***Se compraram:* 6.3.2.1.** Quanto vocês pagaram? R$ |__||__||__|,|__||__| Unidade _____

6.3.3. Quanto vocês conseguiram **nessa última vez**? Quantidade: _____ Unidade: _____

6.3.4. Quantas refeições fizeram com essa caça? |__||__| refeições

6.4. Alguém desta casa pesca, mesmo que seja apenas de vez em quando? |__| SIM |__| NÃO – ***Ir para 6.5***

6.4.1. Em qual época do ano pesca mais vezes? |__|seca |__|cheia |__|vazante |__|enchente |__|ano todo igual

6.4.2. Quantas vezes, no total, alguém da casa foi pescar nos últimos 30 dias (desde _____do mês passado)? |__||__|

6.5. Alguém desta casa caça, mesmo que seja apenas de vez em quando? |__| SIM |__| NÃO – ***Ir para 6.6***

6.5.1. Em qual época do ano caça mais vezes? |__| seca |__| cheia |__| vazante |__| enchente |__|ano todo igual

6.5.2. Quantas vezes, no total, alguém da casa foi caçar nos últimos 30 dias (desde _____ do mês passado)? |__||__|

6.6. Agora gostaria de saber qual tipo de carne o(a) senhor(a) gosta mais entre carne de boi, carne de boi enlatada, carne de porco, frango congelado, galinha caipira, pato, carne de caça, peixe, bicho de casco, jacaré, calabresa e salsicha? E em segundo lugar, qual o(a) senhor(a) gosta mais? E em terceiro lugar?

1ª preferência:_____, 2ª _____, 3ª _____

Se ele(a) listou carne de caça, bicho de casco ou jacaré:

6.6.1. De qual bicho (espécie) o(a) senhor(a) gosta mais? _____

Comentários módulo VI:

VII – SEGURANÇA ALIMENTAR

Agora vou fazer algumas perguntas sobre como você acha que são as condições de alimentação na sua casa.
Nos últimos 30 dias, ou seja, desde o dia _____ (*mesmo dia atual*) do mês de _____ (*1 mês atrás*):

7.1. Vocês, deste domicílio, já tiveram a preocupação de que os alimentos acabassem antes de poderem comprar ou receberem mais comida? |__| SIM |__| NÃO |__| Não sabe

7.2. Os alimentos acabaram antes que vocês tivessem condições para adquirir mais comida? |__| SIM |__| NÃO |__| Não sabe

7.3. Vocês comeram apenas alguns poucos tipos de alimentos que ainda tinham, porque o dinheiro acabou? |__| SIM |__| NÃO |__| Não sabe

Agora vou perguntar apenas sobre você e os outros adultos, com 18 anos ou mais, da sua casa. Algum de vocês, alguma vez, nos últimos 30 dias:

7.4. Deixou de fazer alguma refeição porque não havia dinheiro para comprar comida? |__|SIM |__|NÃO |__|Não sabe

7.5. Comeu menos do que achou que devia, porque não havia dinheiro para comprar comida? |__|SIM |__|NÃO |__|Não sabe

7.6. Sentiu fome, mas não comeu porque não havia dinheiro para comprar comida? |__|SIM |__|NÃO |__|Não sabe

7.7. Fez apenas uma refeição ao dia ou ficou um dia inteiro sem comer, porque não havia dinheiro para comprar a comida? |__| SIM |__| NÃO |__| Não sabe

Nota: *As perguntas abaixo devem ser feitas somente em domicílios com moradores menores de 18 anos (crianças e/ ou adolescentes). Se não houver menores de 18 anos, encerre esse módulo.*

Agora vou perguntar apenas sobre os moradores menores de 18 anos da sua casa. Algum deles, alguma vez, nos últimos 30 dias:

7.8. Comeu apenas alguns poucos tipos de alimentos que ainda tinham, porque o dinheiro acabou? |__| SIM |__| NÃO |__| Não sabe

7.9. Não comeu quantidade suficiente de comida porque não havia dinheiro para comprar comida? |__| SIM |__| NÃO |__| Não sabe

7.10. Foi diminuída a quantidade de alimentos das refeições de algum morador com menos de 18 anos de idade, porque não havia dinheiro para comprar a comida? |__| SIM |__| NÃO |__| Não sabe

7.11. Deixou de fazer alguma refeição, porque não havia dinheiro para comprar comida? |__|SIM |__|NÃO |__|Não sabe

7.12. Sentiu fome, mas não comeu porque não havia dinheiro para comprar mais comida? |__| SIM |__| NÃO |__| Não sabe

7.13. Fez apenas uma refeição ao dia ou ficou sem comer por um dia inteiro, porque não havia dinheiro para comprar comida? |__| SIM |__| NÃO |__| Não sabe

ESCALA SEGURANÇA ALIMENTAR REGIONALIZADA

Nos **últimos 30 dias,** ou seja, desde o dia_____ do mês passado, alguma vez, o(a) senhor(a) ou alguém aqui desta casa:

7.14. Diminuiu a quantidade de carne em alguma refeição para economizar? |__|SIM |__|NÃO |__|Não comeu |__|Não sabe

7.15. Diminuiu a quantidade de peixe em alguma refeição para economizar? |__| SIM |__| NÃO |__| Não sabe

7.16. Trocou carne ou frango por ovo, conserva ou salsicha porque são mais baratos? |__| SIM |__| NÃO |__| Não sabe

7.17. Fez alguma refeição apenas com farinha ou chibé porque não tinha outro alimento? |__|SIM |__|NÃO |__|Não sabe

7.18. Teve que pegar crédito ou comprar fiado na taberna, mercadinho ou vendedor para comprar comida porque não tinha mais dinheiro? |__| SIM |__| NÃO |__| Não sabe

7.19. Emprestou comida de outra família porque faltou em casa e não tinha dinheiro? |__| SIM |__| NÃO |__| Não sabe

7.20. Fez as refeições na casa de vizinhos, amigos ou parentes porque não tinha comida em casa? |__| SIM |__| NÃO |__| Não sabe

Comentários módulo VII:

VIII –INFRAESTRUTURA

8.1. Esta casa é própria, alugada ou cedida por alguém? |__| própria |__| alugada |__| cedida

8.2. *Observar do que é feito a maior parte das paredes*: |__|madeira |__|madeira palafita |__|alvenaria |__|palha |__|barro

8.3. Quantos cômodos para dormir têm aqui na casa que vocês moram? |__||__| |__| nenhum

8.4. Como é o banheiro que vocês usam na casa? |__| com vaso sanitário, dentro da casa |__| com vaso sanitário, fora da casa |__| com buraco |__| não tem banheiro

8.5. Tem energia elétrica aqui nesta casa? |__| SIM - rede |__| SIM - motor de luz |__| NÃO

8.6. De onde vem a água que vocês usam para beber aqui nesta casa? |__| encanada/rede pública em casa |__| encanada/rede pública do vizinho |__| poço artesiano |__| cacimba |__| rio |__| outro _____

8.7. Vocês fazem algum tipo de tratamento ou filtragem antes beber a água? |__| SIM |__| NÃO |__| ÀS VEZES

Se SIM --- |__| filtro de barro |__| outro tipo de filtro |__| coa com pano |__| ferve |__| hipoclorito de sódio

8.8. Vocês têm fossa nesta casa? |__| SIM – fossa séptica/construída com parede |__| SIM – fossa negra/rasa |__| NÃO

8.9. *Observar como é a rua onde fica o domicílio:* |__|asfalto |__|concreto |__|terra |__|maromba/passarela |__|outro_____

8.10. Alguém desta casa tem dificuldade de chegar no trabalho ou estudo em alguma época do ano? |__| SIM – na seca |__| SIM – na cheia |__| NÃO

8.11. Sua casa aqui nesta cidade já alagou/foi pro fundo alguma vez? |__| SIM – esta casa |__| SIM – casa antiga |__| SIM – a casa antiga e esta casa |__| NÃO - ***Encerrar módulo***

8.11.1. Alagou: porque o rio subiu |__| por causa da chuva |__|

8.11.2. Quando foi a última vez que alagou/foi pro fundo? |__||__|/|__||__|/|__|/|__|

8.11.3. Por quanto tempo ficou alagada/no fundo? |__||__| meses |__||__| dias

8.11.4. Vocês tiveram que sair da casa? |__|SIM – foram pra abrigo na cidade |__|SIM - foram pra casa de parentes na cidade |__|SIM – foram pra casa de parentes na comunidade |__| foram pra casa de parentes em outra comunidade |__|SIM – tiveram que mudar de casa definitivamente |__|SIM – outro_____ |__|NÃO

SE não saíram **- 8.11.4.1**. Por que não saíram de casa? _____

8.11.5. Quantas vezes sua casa alagou/foi pro fundo desde que você mora aqui na cidade? |__||__| vezes

8.11.6. Alguma vez tiveram que mudar de casa definitivamente? |__| SIM |__| NÃO

Comentários módulo VIII:

Comentários gerais: