

## Coca-colonization of diets in the Yucatan

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### Abstract

Over the past three decades, tourism-based economic development has transformed social and economic conditions in the Yucatan Peninsula, Mexico. Mayan communities have become directly involved in the changing economy as the main source of inexpensive labor for construction and service jobs at tourism centers, and as sites of ecotourism and archeotourism. In this paper, we address how these macro-processes of change intersect locally with the commoditization of food systems, diets and nutrition in four Yucatec Mayan communities with differing relationships to the tourist economy.

Yucatec Mayan diets have become increasingly dependent on purchased foods, and reflect a greater consumption of commercialized processed foods. *Coca-Cola*, an international icon of US culture, along with other local and internationally owned calorie-dense but nutrient-poor snack foods, is now a common element of Mayan diets, leading to what we call “coca-colonization.” The consequences of this diet, likely exacerbated by the increased consumption of snack foods, include an apparent increase in overweight and obese adults as well as signs of growth stunting in children. The Maya we talked with recognize both the potential disruption that tourism brings to all aspects of their lives and the necessity of jobs that tourism creates to meet their families’ basic needs.

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### Introduction

Throughout Latin America and much of the developing world, nations are turning to tourism as a means for generating foreign capital and economic development. Stonich (1998) notes that international tourism to Central America has grown dramatically since the 1980s, with annual growth rates in arrivals and receipts of 11.5% and 16.8%, respectively, between 1987 and 1991. Mexico is the leader of this trend in Central America, and the primary destination is the Caribbean

coast of the state of Quintana Roo in the Yucatan Peninsula. Cancun, the center of this development, grew from a fishing village of about 426 inhabitants in the early 1970s, to the state’s most important city with a population of over 400,000 people by the early 1990s (Daltauit & Leatherman, 1998). In the last three decades, Quintana Roo has experienced a transformation from one of the most economically marginal areas of Mexico into a tourist bonanza, an unqualified economic success for the Mexican government and foreign investors. The tourism industry also brings cash and increased purchasing power to the many Maya who build and maintain the infrastructures and work in tourism’s service economy.

Anthropological research on tourism has focused on the economic, social, and cultural impacts on local

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communities and peoples. Tourism disrupts local subsistence activities as more small producers turn to wage labor, increases economic and social differentiation (and conflicts), and can lead to the “commodification of culture”, in which cultural items or rituals become valued primarily in terms of their exchange value (Stronza, 2001). Tourism development can affect environmental degradation, water quality, nutrition, and health (Stonich, 1998). Similarly, tourism research in the Yucatan has concluded that as environmental resources, labor, and food become increasingly commoditized, and symbols of prestige become increasingly western, disruptions to environment, economy, culture, and health are inevitable (Daltabuit & Pi-Sunyer, 1990; Daltabuit & Leatherman, 1998; Pi-Sunyer & Thomas, 1997).

The questions raised in this paper concern how these dynamics of change are linked to the production of health in Mayan families and communities. One set of concerns highlights the economic, socio-cultural, and psychological dimensions of these changes. In their study of tourism in the Yucatan, Pi-Sunyer and Thomas (1997) argued that tourism constitutes a totalizing experience which affects not only families’ economic and social activities but also their broader sense of community and cultural identity. A second set of concerns that we address more centrally in our research relates to how tourism-led development has affected Mayan food systems, diets, and nutritional health. One of the major ways that local communities interact with their environment, and reflect and reify culture is through food systems. Hence, changes in food systems and diets are a critical piece of the cultural and social transformations that accompany tourism-led development. In turn, dietary changes directly link development to measurable changes in human nutrition and health. Since the pioneering work by Scrimshaw, Taylor, and Gordon (1968), the negative synergism between nutrition and disease is well known. Macro and micronutrient deficiencies can impact health by affecting growth, physical and cognitive development, working capacity, reproduction, immune systems and disease resistance, and also the absorption and utilization of other nutrients (Allen, 1984, 1993; Martorell, 1980, 1989; Chavez & Martinez, 1982).

Based on our research in the Yucatan since 1989, and work by Daltabuit (1988) and Pi-Sunyer and Thomas (1997), we expected that there might be considerable variation and ambiguity in how tourism-led social, economic, and cultural change affects nutrition, health, and other indicators of well-being. Some individuals spoke of the past 20 years as having been a time of increased income and economic resources, better and more diverse diets, and an improved quality of life. Others noted declines in agricultural productivity and the availability of locally produced foodstuffs, which for

them meant a diminished dietary diversity. Studies of child growth, as an indicator of community nutrition and health in the Yucatan Peninsula (Gurri & Balam, 1992; Gurri, Balam & Moran, 2001; Leatherman, Stillman, & Goodman, 2000), have noted an increase in stature and weight over the past few decades indicating improved health and/or nutritional conditions. However, stature is still low, indicating the persistent presence of chronic undernutrition. Gurri and Balam (1992) further note that caloric undernutrition is a lesser problem now than in the past, but that other nutrient deficiencies continue to affect nutritional status in Mayan communities. Also, adult obesity and associated diseases such as hypertension and diabetes are clearly increasing in urban and peri-urban locales in the Yucatan (Dickinson, Castillo, Vales, & Uc, 1993). Dickinson et al. (1993) depict current shifts in Mayan diets in and around Merida (the capital of Yucatan) as indicative of a “double-edged sword of malnutrition,” where childhood malnutrition is replaced by adult obesity later in life. Here, we go a step further in suggesting that this doubled-edged problem of micronutrient undernutrition and adult obesity is in part due to coca-colonization.

These ambiguities reflect the manner in which the social, cultural, and health impacts of tourism-led development are distributed unevenly and experienced unequally among Mayan communities, families, and individuals. Much of this variation is influenced by the manner and degree to which communities, households, and individuals articulate with the tourism-based economy and their relative economic success. For example, in households with steady, predictable incomes, an increase in markets can provide access to more foods throughout the year, enhanced dietary diversity, and improved nutritional status. However, past research has more commonly found that a movement away from traditional diets and towards greater market dependency often has the opposite effect: a decline in the dietary diversity and nutritional status of peasant communities (e.g., Pelto & Pelto, 1983; Dewey, 1989). As fewer local foods are produced and reliance on market foods increases, cash poor households are likely to suffer nutritionally.

In this article, we address how tourism-based economic development creates the conditions for new and often unequal social relations, food systems and diets, thereby resulting in differential nutrition and health of Yucatec Mayans. Specifically, we explore the linkages between food commoditization, diet, and nutritional status in Mayan communities and households with qualitatively and quantitatively different involvement in local food production and the tourism economy. High calorie, low-nutrient snack foods are a particularly strong and pernicious example of commercialized processed foods, and we are interested in understanding

their increasingly common and widespread consumption and potential impact on child and adult nutritional status.

### *Background*

Until relatively recently, the Maya of the Yucatan Peninsula had successfully resisted greater assimilation into the Mexican and Western cultural and economic systems. This is no longer the case. Mayan communities are enmeshed in the broader tourism-based economy as construction workers, tour guides, and artisans, as well as waiters, maids, and gardeners in tourist resorts. The movement of people and goods is facilitated by a recently expanded road network that now connects Quintana Roo with its bordering states. Cancun is linked to Merida by a toll road ‘super-highway’, and is connected to the world through an international airport that by the mid-1990s was bringing in over 1.5 million foreign tourists each year (Pi-Sunyer & Thomas, 1997). The 126 km of coastline leading south from Cancun to the historic community and ancient Mayan archeological site of Tulum is well on its way to being completely developed. Many of these developments are gated resort communities catering to tourists of specific nationalities, while the beachfront accessible to Mayan residents is quickly diminishing.

While Mayan communities have a long history of articulation with capitalist enterprises in boom and bust economic cycles (e.g., sugar, chicle, and henequen production systems), they have always relied upon and enjoyed the security of slash-and-burn *milpa* agriculture. This locally based production system provided the key staples of corn, beans and squash, complemented with fruits, peppers, herbs, medicinals, chickens, turkeys, and pigs, all grown in home gardens (Kintz, 1980). With the growth of the tourist economy, however, households and communities have become increasingly dependent on the large urban centers for income (Daltabuit & Pi-Sunyer, 1990; Kintz, 1980), and we have observed that reliance on *milpa* agriculture and home gardens often declines (Daltabuit & Leatherman, 1998). A new generation of Mayans prefer to seek their fortune in ‘Cancun’ (i.e., the tourist economy), rather than in the *milpa*. Some young men refer to the drudgery of *milpa* work as ‘*trabajo rudo*’ (coarse, rough work), preferring service jobs or even construction work at tourist centers. Despite a continued practice of patrilocal residence, some young families have ceased to pool resources and labor, or even share food and meal preparation with their parents and in-laws. This reflects a social independence consistent with economic independence for young families; yet for their parents, it reflects an erosion of the very meaning of family and community and, in more practical terms, means an erosion of social and economic security for parental generations, and poten-

tially a scarcity of labor for *milpa* production and household domestic tasks.

Decreased *milpa* production and a growth in commoditized food and labor markets have increased Mayan dependence on non-traditional and store-bought foods (Daltabuit, 1988; Daltabuit & Leatherman, 1998). Although shifts from locally produced to market and commercialized foods have been associated with improved levels of nutrition in industrialized nations, such shifts often have a negative impact on nutrition in developing countries (Pelto & Pelto, 1983). In many developing countries, of which Mexico is no exception, rapid economic development leads to large disparities in wealth rather than increased wealth for the population as a whole. Therefore, while growth in markets may increase dietary diversity, much of the population may be unable to afford market prices, and decreased subsistence production coupled with an inability to purchase foods will lead to reduced dietary diversity (Pelto & Pelto, 1983; Dewey, 1989).

The exception to this pattern might be found in households with steady, predictable incomes and hence access to greater dietary diversity. Adequate cash flows provide households with real access to markets, from which they can buy a diversity of better quality foods at less expense and in greater bulk. A steady income can also serve to dampen seasonal variation in the availability of locally produced foods, especially in regions such as the Yucatan with a single main rainy and growing season. Thus, shifts toward commoditized food systems provide a context in which inequalities in access to adequate diets might emerge and increase.

### **Research design and methods**

#### *Community contexts*

To examine how the tourism-led economic change has produced different patterns of food systems, diet, and nutritional health in the Yucatan, we have been conducting research in Mayan communities that differ in subsistence base and articulation with the tourist industry. These include two inland communities, Yalcoba and Coba, and two coastal communities, Akumal and Ciudad Chemuyil. We conducted research on health and nutrition in Yalcoba in 1989 and 1991, and a preliminary dietary survey in Coba and Yalcoba in 1994. We then carried out household dietary surveys in the coastal communities in 1996, and in Yalcoba and Coba in 1998, as well as studies of child growth in Yalcoba in 1998. This work has been part of a larger effort of a group of anthropologists studying the social, economic, cultural, and health effects of the rapid growth in the tourist economy in the Yucatan, including students and professors (Brooke Thomas and Oriole Pi-Sunyer of the

University of Massachusetts, and Magali Daltabuit of UNAM in Mexico) from the US and Mexico. We draw liberally from their insights, as well as our observations and experiences, in presenting the contexts of research.

One set of communities, Akumal and Ciudad Chemuyil, arose as service villages to popular resorts on the Caribbean coast. Many of the immigrants to these communities came from two inland Mayan communities in the state of Yucatan, Sotuta and Kantunil. Ciudad Chemuyil was designed and built in the 1990s by a consortium of hotels and the Mexican government to house the growing worker population needed for the expanding tourist industry (Pi-Sunyer & Thomas, 1997). It consists of a school, stores, a few restaurants, and about 250 cinderblock homes on small plots of land. Residents have no agricultural land and little land for home gardens, and thus are totally dependent on local markets for access to food.

The community of Akumal first arose as a squatter settlement on land adjacent to the resort of the same name. Residents were subsequently forced to move to Ciudad Chemuyil, or to another site about 5 km away (also called Akumal), on the other side of the main highway that runs along the coast. The new Akumal community includes stores, a school, and housing plots of different sizes that might allow for a fruit tree or small home gardens.

Kinship relations often connect families from the two communities. Some families have moved back and forth, and intermingle with the local (tourist) economy and food systems in similar ways (e.g., as construction workers, gardeners, waiters, cooks, maids, tourist guides, and small-scale entrepreneurs running businesses oriented toward tourists or fellow residents). Neither has the resources to produce their own food and must rely on local markets. Therefore, despite the distance and the different physical layouts and origin of these two communities, for this paper the households interviewed in each are combined to form a single sample representing a coastal service community.

A third community, Coba, is a farming village of about 900 persons, settled about 50 years ago by immigrants from nearby zones looking for new land (Kintz, 1980). Some residents work in the coastal tourist economy, but far more are involved in the tourist economy through “archeotourism”, because Coba is the gateway community to the famous Classic Maya archeological site from which the community takes its name. Taking advantage of the flow of approximately 60,000 tourists per year to the archeological site (Pi-Sunyer & Thomas, 1997), the town of Coba currently hosts a smattering of tourist-oriented businesses including a few restaurants, about a dozen souvenir shops, and two hotels (one budget and the other run by Club Med). By all accounts, tourism in Coba is highly seasonal: some restaurants and stores

stay open only during prime tourist season. While there are visible signs of asymmetries in wealth between local entrepreneurs and small-scale producers, real incomes (and improved diet diversity) are reported to vary seasonally based on highs and lows in tourism. Coba has a wealth of land for making milpa, but one informant estimated that only about 50% of *ejiditarios* (individuals with access to communal ejido lands for farming) planted fields in 1998, and that many of those who did, hired someone else to plant for them.

Yalcoba, the fourth community, is an old settlement of about 1500 inhabitants, located near the town of Valladolid, toward the center of the Yucatan peninsula. A 16th century church and near-by classic and post-classic Mayan ruins stand as testimony to the long settlement history of the town. In contrast to the other communities, Yalcoba has little direct exposure to tourism, but many of its men and some women work at construction and service jobs in Cancun and other tourism areas. The percent of households involved in the Cancun migration increased steadily between the mid-1980s and mid-1990s from about 45% to over 75% (Daltabuit & Leatherman, 1998). As well, hammock making on consignment has emerged as another source of cash generation. Otherwise, there are few local opportunities for wage work. In contrast to Coba, ejido lands in Yalcoba are limited in size and overworked, making it difficult for young families to engage in home food production. The only way to obtain new lands for the community has been to petition the government for an expanded ejido, but these fields would necessarily be even farther from the community. Already, some younger households with limited access to ejido lands might walk over 12 km to get to fields. Because the community and number of *ejiditarios* have grown, fields are left fallow for shorter periods between planting, and this leads to decreased productivity. Decreased productivity in farming was a common response by local residents to questions about what they considered major changes in the region over the past three decades.

### Methods

We conducted surveys of 30 coastal households (15 in Akumal and 15 in Cd. Chemuyil), and 30 households each from Coba and Yalcoba. The surveys collected information on household demographic, social, and economic characteristics, food acquisition (e.g., from *milpa* production, home gardens, and purchases in local stores and larger markets), and dietary intake, as well as a variety of perceptions of social change, soft drink consumption, and the quality of local vs. non-local foods. In each community, we also visited most stores and noted the range of foods and products, and the marketing displays of sodas and snack foods. We asked store owners about food purchasing patterns in the

community, and supplemented this information with opportunistic observations (30–60 min) of purchasing patterns of visitors to larger stores as part of participant observation. In 1998, we collected anthropometric data on school children in Yalcoba, measuring height, weight, upper-arm circumference, and triceps and subscapular skinfolds, according to standard techniques (Frisancho, 1990). Finally, we rely on participant observation and informant interviews, during repeated visits to all communities (but especially Yalcoba) over a 4-year period, to better understand the changing economic strategies, diets, and degree of commercialization of the food system.

The dietary data presented here are derived from a 7-day food frequency and recall from the family: both how often a food item was eaten and the amount consumed over a week. Because recalls of the frequency and quantities of some foods eaten at meals during the week were not precise, some of the data on quantity of consumption was collected in terms of food purchased and prepared for the entire family. For example, the female head of household knew exactly the amount of *masa* (corn meal) used and consumed as tortillas, even if individual members could not recall how many tortillas they ate for a given meal or day.

From earlier pilot surveys, the work of Daltabuit (1988), and information from informants, we developed a food list to prompt for foods eaten regularly, and inquired about other foods consumed in the previous week. Given this background information, and because households consume primarily what is stored from earlier harvests or what they purchase from local markets, we are confident that all or most foods consumed in the home were recorded. We may have missed some foods consumed out of the household, especially sodas and snack foods consumed by children; thus, these items are likely underestimated in weekly recalls. It is important to note that these dietary data were collected in the summer months (mostly June and July), and, therefore, do not represent the seasonal variation of an annual diet. Also, they are a measure of consumption in the household residence and do not include diets of workers living away from the family during the week.

We analyze and report the data from the household weekly food consumption in three ways. First, we list key food items and their caloric contribution to the diet to illustrate the range of dietary diversity in each community. Dietary diversity is an important measure of dietary quality because more diverse diets tend to be more nutritionally balanced if caloric requirements are met (Allen, Backstrand, & Stanek, 1992). Second, as another measure of diversity and quality of diets, we present the caloric contribution of macronutrients (carbohydrates, fats, proteins) and protein quality in each community. Protein quality (PQ) is an indicator of

the availability of protein (and its constituent amino acids) in the diet. A low PQ indicates that one or more amino acids are deficient. Third, we provide an estimate of how rich diets are in micronutrient intakes (i.e., vitamins and minerals) by presenting the amount of select micronutrients standardized to a 2000-kcal daily intake (i.e., amount of micronutrient present in a 2000-kcal diet). Data entry and analyses were done using The Food Processor<sup>®</sup> Nutrition Analysis Software from ESHA Research, Salem, OR (Version 7.0).

Recent work had suggested that caloric undernutrition among Mayan communities in the Yucatan was much less of a problem than in past decades (Gurri et al., 2000), perhaps a benefit of the market and government-sponsored stores (CONASUP) that now provide basic staples. Hence, attention has turned to micronutrient deficiencies as a critical nutritional problem. These deficiencies have likely always been a problem but received less attention compared to caloric deficiency. Also, the nature of the weekly household food frequency did not consistently yield precise caloric intakes for individual family members, and lent itself better to analyses of nutrient density based on a standardized caloric intake.

In order to evaluate the adequacy of nutrient densities, we compared our results to densities required to meet recommended dietary allowances (RDAs) for a 7–10-year-old child with a caloric requirement of approximately 2000 kcals per day. We chose to estimate adequacy of micronutrient intake in children for three reasons. First, children in the 7–10-year age range are less likely to be away from the household for meals during the week. Second, child growth is frequently used to estimate the nutrition and health of entire communities, and thus our estimates of dietary quality and nutritional status are made in roughly similar age groups. Third, by estimating dietary adequacy in children, we are providing a more conservative measure of micronutrient deficiency for the community and household. While children often do not have equal access to all foods served at the family meal, our estimates assume that they do, which may underestimate deficiencies. Two other factors make for conservative estimates of micronutrient deficiency. First, nutrient densities are based on the dietary diversity of a weekly food intake, yet daily diets were substantially less diverse (e.g., meat was often only eaten on weekends). Second, our estimates do not account for reduced bioavailability (absorption and utilization) of nutrients, a frequent characteristic of less diverse diets.

Child growth and body composition is a commonly used indicator of nutrition and health status for individuals and communities and is presented here as a link between dietary quality and nutritional status. The analysis has two goals. One is to illustrate a potential link between dietary quality, nutrition, and health for at

least one community (Yalcoba). The other is to draw suggestive links between tourism-based economic change, diet, and child growth. Because our most complete sample of child growth was obtained in Yalcoba, and data collected previously in Yalcoba is available for comparison (Daltabuit, 1988), we use only the growth data from Yalcoba in the present analysis. Also, we were able to calculate estimates of adult body mass index (BMI) in Yalcoba using stature and weight measurements from clinic records, and this provides data for a broader pattern of growth, body composition, and nutrition for this community.

### Food commoditization

As milpa production has declined and the availability of markets with foods produced outside of the area have increased, Yucatecans are increasingly consuming goods and foods produced out of the area—a process of dietary delocalization. The nature of food commoditization, however, is markedly different for the coastal (Akumal and Ciudad Chemuyil) vs. inland maize-producing communities (Coba and Yalcoba). In the coastal communities, a fully commercial and commoditized system is now in place. Most foods are purchased year round from local stores, weekly markets, and traveling vendors specializing in food stuffs from specific growing regions. For example, fruit is typically purchased from vendors bringing it from Oxkutzcab, a farming and orchard town to the west, while meat is often bought from vendors from Sotuta, a town closer to Merida and the original home of a number of residents. Weekly markets adjacent to the resort community of Akumal and nearby Tulum bring vendors and food from Chiapas and occasionally farther west. Local *tiendas* (small variety stores) sell basic staples, canned goods, sodas, and snack foods. Local restaurants, sandwich shops, and pizzerias offer noon and evening meals for residents and workers. Workers within the resorts purchase soft drinks, candy bars, and chips at tourist prices for morning snacks and noontime meals from *tiendas* in the resorts.

In the two inland communities, products from the milpa (primarily corn, beans, squash, melons) are harvested and available for consumption seasonally. Most produce is consumed within the household, although the general availability of local products increases during these times. A common complaint in both Coba and Yalcoba is that the productivity of local *ejido* lands had decreased markedly in the past several decades. Very few families grow enough corn to last a year, and more foods of all sorts must be purchased, especially during the summer months leading into the next harvest. We noted no great differences in the degree of food commoditization in Yalcoba and Coba.

By the mid-1980s in Yalcoba, Daltabuit (1988) had already noted a shift from local foods and drinks that had been important in the past (such as honey, tubers, and wild meat) toward commercial foodstuffs (including rice and pasta), of which sodas and snack foods were key elements. This trend was even more pronounced in the 1990s. Even maize and beans, two key staples, are often bought from government-subsidized stores (CONASUP) that import them from Chiapas and beyond. Local *tiendas* sell small quantities of produce (tomatoes, potatoes, cabbage, carrots, onions, garlic, and peppers) and a few staples (dried beans, rice, and pasta) purchased in larger towns and resold locally. Some households in both communities travel to the nearby city of Valladolid in order to purchase better quality and a wider choice of fruits, vegetables and meat at lower cost. Taxis now regularly make the 24 km trip between Yalcoba and Valladolid, facilitating these trips. Locally grown fruit is available seasonally and other fruits are brought to the villages by vendors in trucks and then distributed on tricycles. Fruits and vegetables do not preserve well in the heat, and the only households able to consume a variety of fruits and vegetables year round are those few with refrigerators (their purchase made possible by the increased cash from wage work). In addition to extending the life of produce and meats, families with refrigerators often stock and sell sodas.

Compared to 10 years ago, a greater variety of foods is available in rural communities, but at a higher cost to households. As one resident of Coba noted “there are more foods available now, but no money to buy them.” Thus, many households in the more rural communities of Coba and Yalcoba see the past 20 years as a time of steadily decreasing food availability. Moreover, there is a preference for the taste, quality, and storage capacity of local foods over those bought through CONASUP. A few individuals stated that local foods were fresher and (nutritionally) better than those from other areas. Thus, while a commercialized food system and dietary delocalization is universally accepted, the replacement of local staples and foods by those from another region does not go unnoticed or uncritically accepted.

### Coca-colonization

The most dramatic aspect of the commercialization of food systems in the region is the pervading presence of *Coca-Cola*<sup>®</sup>, *Pepsi*<sup>®</sup>, and an assortment of chips, cookies, candies, and other high-sugar, high-fat snack foods, collectively called “*comidas chatarras*” (junk foods). Such foods are frequently labeled as ‘empty calories’ or ‘calorie-dense but nutrient-poor’ foods. This does not mean all snack foods have no useful nutrients. For the most part the sodas and candies are ‘empty’ of nutrients, while chips and cookies provide limited

amounts of nutrients. However, the nutrient contributions relative to sugar or fat are small.

While Coca-Cola products have been distributed in Mexico and the Yucatan since the early 20th century, bottled soft drinks became a staple commodity when road networks and electricity—hence refrigeration—were established. This infrastructure development was accelerated in the early 1970s with the development of the coast as a tourist zone. By the 1990s, Mexico had already become one of the world's largest consumers of soft drinks, with an annual per capita consumption of 560 8-oz. servings accounting for over 20% of Pepsi's and 15% of Coke's international sales (Jabbonsky, 1993). In 1999, their annual per capita consumption of 431 servings of Coca-Cola products alone was the highest of any country in the world, and marked a 23% increase over the previous 5 years (Coca-Cola Company, 1999). Mexico, and the Yucatan, is the site of an ongoing "Cola War" between Coke and Pepsi, as executives see it—a fight over the "stomach share" of the Mexican people. Coke's goal and company slogan is "an arm's length from desire"—that is, to make Coke available at every corner in every town or village in every part of Mexico (Pendergrast, 2000). Indeed, this goal seems to be met in Yalcoba, where one can purchase a soft drink, and often a Coke, at over 40 tiendas.

Pepsi has waged their version of the "Cola Wars" using a strategy of "the Power of One". This entails marketing Pepsi soda in conjunction with junk foods. Pepsico's logo is found on the majority of the chips, cookies, candies, and other processed snack foods seen on prominent displays in tiendas. This has been a successful strategy that has helped them capture market shares from Coke. It is likely, then, that Coca-Cola will have no choice but to compete by creating their own linkages between beverages and snacks. If this comes to pass, the fight for "stomach share" will intensify and we can expect to see an even greater penetration of soda and snack foods in the diets of Mexicans and the Yucatec Maya.

Currently in Coba and Yalcoba, both Pepsi and Coke trucks make weekly visits to large and small stores. In order to acquire new clients, company representatives will paint new signs on tiendas, set up display cases, and provide coolers for the sodas. Upon entering almost any tienda, displays of snack food are the first things to catch one's eyes. In addition to sodas and name brand snack foods, jars of cheap candies are found on most counters. Indeed, our observations suggest that most children who enter tiendas leave with some form of candy, chips, or a drink. Moreover, given the few opportunities for small investment in Yalcoba or Coba, many home-based stores have sprung up locally, doing little more than selling sodas. A 5-min walk now puts all but the most isolated households in the community within "an arm's length of desire".

Local distributors of soft drinks in Coba and Yalcoba in 1996 and 1998 reported weekly sales reflecting an average per capita consumption of one soda per day, while in the coastal service villages of Akumal and Chemuyil consumption is at least 50% greater. Also, given that the very young and very old consume fewer soft drinks, these estimates should be higher for children, adolescents, and adults. In 1996, 75 school-aged children in Yalcoba reported average daily intakes of just over one 12 oz. soft drink (mostly Coke or Pepsi), 1.5 packaged snack foods (e.g., chips or cookies), and 1.7 small candies (e.g., suckers). Maximum daily individual consumption rates reported were about four to five sodas, seven snack foods, and six candies. During a morning school break in Yalcoba, it is typical for children to buy a soft drink and a snack. This simple treat accounts for nearly 400 cal, about one-fifth of an elementary school child's daily requirement (Daltabuit, 1988; McGarty, 1995). They are largely consumed away from the household and are consequently underreported in weekly dietary reports.

For our informants, coke is not food (*alimento*): it has no redeeming nutritional qualities, other than being sweet with sugar. Rather it is drunk "*por gusto*"—for pleasure and taste. Indeed, to see a man or woman taking a break from work on a hot afternoon with a cold soda illustrates the role of soft drinks as providing a moment of leisure and pleasure. Yet many feel that one can drink too much, and speak of how consuming too many cokes in one's youth makes one 'accustomed to' wanting a soda. Informants in the two inland communities consider cokes and other sodas too strong and inappropriate for babies and young children; they can cause parasites, gas, and stomach cramps. Nevertheless, it is not uncommon to see a young infant with a coke or another soft drink.

### Food consumption

A community comparison of foods commonly eaten by percent contribution to energy is presented in Table 1. As might be expected, individuals surveyed from the coastal resort service communities of Akumal and Chemuyil have a greater dietary diversity; eight types of foods contribute at least 5% of total caloric intake, compared to four to five foods in the two inland communities. Compared to inland communities, weekly food frequencies in the two coastal communities include half the tortillas, three times the sodas and snack foods, three times dairy, twice the fruits, and from one and a half to four times the meat contribution to calories. For each of these food items, and for sugar, the differences among the communities is significant (Anova,  $p < .02$ ), and the difference is primarily based on values in the coastal vs. inland communities. The two inland

Table 1  
Commonly consumed foods and macronutrients

	Coastal ( <i>N</i> = 26)	Coba ( <i>N</i> = 30)	Yalcoba ( <i>N</i> = 24)
<i>Food items</i>			
Tortillas	23.0	44.0	46.0
Oil/lard	12.0	10.5	9.5
Sodas/snacks	12.0	4.5	4.0
Sugar	4.0	6.0	4.0
Beans	5.0	6.0	6.0
Meat	8.0	2.0	5.0
Rice/pasta	4.5	5.5	3.0
Bread/crackers	5.0	4.0	3.0
Fruits	6.0	3.0	3.0
Eggs	3.0	2.5	2.0
Dairy	3.5	1.0	1.0
<i>Macronutrients</i>			
Carbohydrate	62.5	69.3	68.6
Fat	29.2	23.3	23.2
Protein	11.6	10.6	11.0
Protein quality	79.0	67.0	73.0

The top part of this table lists the percent contribution of commonly consumed food to total caloric intake (median value) and the bottom part provides the percent estimated total contributions of macronutrients to energy and protein quality scores.

communities differ significantly only in meat and sugar consumption (*t*-test,  $p < .01$ ).

Maize tortillas are the major contributor to caloric intake in all communities, but especially in Coba and Yalcoba (Table 1). Oil and lard are next, followed by soft drinks and snack foods. Together, sugar and these snack foods account, on an average, for 16% of calories in the coastal communities, compared to 10.5% in Coba and 8% in Yalcoba. Beans and rice/pastas are fairly evenly represented in the three communities. Meat and eggs (combined) comprised 11% in coastal diets, 7% of Yalcoba, and only 4.5% in Coba. The greater meat consumption in Yalcoba was due to more local production of pigs and beef, and the closer proximity of Yalcoba to markets in Valladolid. The main source of dairy in both inland communities is powdered milk, often consumed as a chocolate drink for breakfast. Fruit consumption during the survey was comprised almost entirely of locally produced fruits, specifically mangoes in Yalcoba and guayas in Coba.

The percent of calories coming from the basic macronutrients (carbohydrate, protein, and fat) is subtly different in the three locales (Anova,  $p < .01$ ). The relative contributions of protein and fat are higher on the coast, and more of the protein comes from meat and other animal products. Hence, PQ scores of coastal diets are higher than in Yalcoba and Coba (Anova,  $p < .01$ ).

Yalcoba and Coba do not significantly differ in macronutrient contribution to caloric intake, but Yalcoba does have significantly greater PQ scores ( $p < .03$ , *t*-test).

The smaller consumption of tortillas in the coastal communities is both a material and symbolic reflection of dietary change. Part of the difference is based on incomes and the role of tortillas as an inexpensive staple that can be used to feed and fill the stomachs of large families with limited resources. In coastal communities, we failed to find a relationship between tortilla consumption and household economic status, or between consumption of tortillas and other foods. In the two inland communities, however, higher tortilla consumption is a sign of relative decreased consumption of most other staples (oil, rice/pasta, dairy in Coba, and rice/pasta, meat sugar, beans, and fruit in Yalcoba;  $p < .05$ ), and is indirectly a sign of relative poverty. Yet, tortillas are also culturally and symbolically important. While watching government trucks unload corn and other foodstuffs following a major hurricane and drought in 1991, a friend in Yalcoba muttered, "How many of us will starve this year?" We commented on the quantity of corn being unloaded, and she replied that this corn was not suitable for making good tortillas. For her, and others, without tortillas there is no real meal, amounting to symbolic and psychological (if not nutritional) starvation.

Not only are fewer tortillas eaten in coastal communities but increasingly those consumed are processed soft white flour tortillas, as opposed to corn tortillas typical of most rural areas and both Yalcoba and Coba. This shift, accompanied by greater consumption of bread, crackers, and other replacement starches, reflects the marked shifts in preferences and dietary styles, as well as coastal community lifestyles. If we consider the cultural position of locally made tortillas in inland farming communities, the same sort of communities from which coastal residents emigrated, then these shifts in consumption patterns on the coast can provide a metaphor for broader cultural transformations and lifestyles that have occurred in a relatively short time.

#### *Micronutrient profiles*

Micronutrient adequacies are based on a 7-day food record and estimates of nutrient adequacy for a 7–10-year-old child consuming 2000 kcals daily (Table 2). The more diverse diets of the service communities on the coast provide greater density and adequacy for most nutrients compared to the inland communities (Anova,  $p < .01$  for vitamins A, B2, B12, and E). The only exception is zinc, which is also low in Coba and Yalcoba. Our analyses detected other potential deficiencies in Coba and Yalcoba: vitamin B2 or riboflavin, B12 (cobalamin) and vitamin E in



Table 2  
Percent RDA's for micronutrient intake based on US child, 7-10 years (median value).

Micronutrients	% RDA		
	Coastal %	Coba %	Yalcoba %
Vitamin A	> 100	53.1	85.1
Riboflavin	> 100	74.9	74.5
Vitamin B12	> 100	63.8	76.7
Vitamin C	> 100	> 100	> 100
Vitamin E	> 100	87.7	59.9
Iron	> 100	> 100	> 100
Zinc	69.6	72.1	79.5

Data are based on weekly food frequencies questionnaires.

Yalcoba; and vitamins A, B2, and B12 in Coba. In both the inland communities, tortilla consumption, as an indirect reflection of poverty, is negatively correlated with a number of micronutrients such as vitamins A, B12, C, E, and specifically with PQ scores in Coba, and vitamins B12 and E in Yalcoba ( $p < .05$ ). In addition, the high phytate content of corn greatly decreases the bioavailability of zinc and iron (Allen et al., 1992).

The greater vitamin A (retinol) intake in Yalcoba compared to Coba ( $p < .03$ ,  $t$ -test) is almost entirely due to the widespread availability of mangos from local *solares* (home gardens) and the relative paucity of mangos and other locally available fruits in Coba. Both the inland communities ingest adequate levels of vitamin C due in part to regular consumption of '*chaya*', a leafy plant grown in home gardens, that is high in protein and several micronutrients, including vitamin C. The contribution of mangos and *chaya* to local diets illustrates the critical importance of home gardens to diets, and specifically to micronutrient profiles.

The importance of incomes for shaping diets and nutrient profiles is illustrated by comparing households from Yalcoba with steady employment in the tourist economy (and relatively higher incomes) and others relying on local subsistence production and irregular wage work to meet basic needs (Table 3). Households with steady incomes eat 20% fewer tortillas, over twice the amount of meat/eggs, fruit, and other sources of complex carbohydrates (rice, pasta, breads, crackers). The percent contribution of protein to calories (11.8%) and the median PQ score (80.5) is slightly higher in these higher-income families than the average for the coastal communities (Tables 1 and 3). Due to small sample sizes, significant differences are found only for tortilla, bread, and fruit consumption, and for PQ ( $p < .01$ ,  $t$ -test). Households with steady incomes also have relatively higher levels of vitamins A, B2, and B12 but are not immune to the generally low levels of vitamin E and zinc (all nutrient comparisons not statistically signifi-

Table 3  
Diet composition and nutrition in Yalcoba households of different economic positions (% RDA's for US child 7-10 years: median values)

Dietary component	Steady income "Cancun" (N = 10)	Milpa production and irregular wages (N = 14)
<i>Foods (% kcal)</i>		
Tortillas	31.5	51.5
Oil/lard	10.0	9.0
Sugar/sodas/snacks	9.0	8.0
Meat & Eggs	7.0	3.0
Beans	6.0	5.0
Rice/pasta	5.0	3.0
Bread	5.0	1.0
Fruits	6.5	2.5
Dairy	1.5	0.0
<i>Macronutrient (% kcal)</i>		
Carbohydrate	65.3	70.0
Fat	25.9	22.6
Protein	11.8	10.7
Protein quality	80.5	69.5
<i>%RDA of micronutrients</i>		
Vitamin A	91.8	71.1
Riboflavin	78.1	73.9
Vitamin B12	82.6	69.7
Vitamin E	59.9	60.1
Zinc	81.6	77.9

cant). These comparisons also suggest that families in Yalcoba relying on irregular wage work and milpa production may be experiencing deficiencies in vitamin A, as well as deficiencies in the B vitamins, vitamin E, and zinc.

Households with steady employment can purchase a variety of foods year round, while others households are more dependent on the local harvest and temporary wage jobs. And given a string of poor harvests and natural disasters, most families depended on wage jobs to acquire the foods they ate. Yet employment in the tourist industry is often unpredictable, both in availability of work and adequacy of wages. Temporary work in Cancun without benefits or health care is usually available, but the kind of steady employment with a living wage associated with improved dietary diversity and micronutrient profiles is more rare, and is dependent on skills, interpersonal relationships, and luck. Besides regular access to cash, another key difference we saw in economically successful households was owning a refrigerator, which enabled these families to consume meats, fruits, and vegetables more regularly and to buy in greater quantities at more economical markets in larger towns.

In contrast to Yalcoba, we found no clear differences in diet and nutrient profiles between households of different economic status in Coba. We believe one reason for this was that the timing of the dietary surveys coincided with a summer planting–growing season, and a slow-down in tourism. As one relatively wealthy individual observed, “restaurant and other tourist-based business owners are on equal footing with poorer households during the off seasons. They might eat meat every day during peaks in the tourist season, but are lucky to eat it once a week in the off-season.” One teacher related how school children are awake, attentive, and energetic during the peaks in the tourist season. During the summer months, many come to school with no morning meal, and are sleepy, inattentive, and lethargic.

We also found no association between occupation and food consumption in the coastal communities. It appeared that all households had sufficient incomes to purchase adequate diets, and while differences might exist in the number of meals eaten away from home or in the number of more expensive foodstuffs consumed, basic staples and micronutrient profiles were roughly similar.

In summary, inland diets look somewhat like historical Mayan diets, but with clear differences too. A broader array of fruits, dairy, meat, alternative complex carbohydrates, and sodas and snack foods are now available. Also, some foods and dishes historically important in local diets (e.g., honey, wild meat, *atole*, etc.) are now rarely consumed in the communities studied. Coastal diets exhibit an even broader array of foods available and regularly consumed, none of which are produced locally; all are commercialized, and many are processed.

It appears that caloric intakes are generally adequate, a great improvement over recent decades (Daltabuit, 1988; Daltabuit & Leatherman, 1998; Gurri et al., 2001). Protein intake appears to be adequate in quantity, but less so in quality. In the case of Coba, for example, where only 10.6% of calories come from protein and with a PQ score of only .67, one might suspect some functional consequences. Thus limits in protein, PQ and micronutrients such as zinc might be responsible for the continued presence of stunting, even though caloric intake may be generally adequate and average heights have increased over previous decades (see below, and Gurri et al., 2001).

While caloric intakes appear to be generally adequate, the dietary profile suggests potential micronutrient deficiencies in vitamins A, B2, B12, E, and zinc for the two inland communities. In Yalcoba households with a source of steady income, only vitamin E and zinc appear to be low, while in poorer families without steady incomes, levels of each of these micronutrients evaluated are near or below 75% of the RDA, suggesting micronutrient deficiencies.

The requirements and bioavailability of micronutrients also vary with other dietary components that might exacerbate existing deficiencies. Plant-based diets high in fiber and phytates are associated with low bioavailability of a number of micronutrients such as zinc, iron, calcium, and vitamin B12 (Allen et al., 1992; Calloway, Murphy, Beaton, & Lein, 1993). Also, as dietary phosphorous and protein increases, zinc requirements increase (Sandstead, 1982). All communities met their RDAs for protein, and far exceeded RDAs for phosphorous (between 200% and 240%) and fiber (140–175%). Hence it is likely that requirements for zinc are elevated and bioavailability is limited by the dietary structures in all communities, but especially in the two inland communities of Coba and Yalcoba. The potential micronutrient deficiencies described here gain importance in high maize diets and when considering the shifts in dietary diversity toward the consumption of more soft drinks. When the remaining “non-maize” calories in a “high maize” diet come from sugar, soft drinks, and snack foods, it is likely that marginal nutrition will become worse.

### Nutritional status

In order to evaluate the nutritional status of individuals from these communities, anthropometric data on school children were collected and compared to earlier studies from the region. Children were classified for stature and body composition based on the US National Center for Health Statistics (NCHS) reference data, and the classification systems of Waterlow (1984) for stature, and Frisancho (1990) for weight-for-height. Individuals are classified as stunted if they fall at or below two standard deviations from the NCHS reference data for stature within 1-year age groups [calculated as Z-scores: (individual value–mean of NCHS reference standard)/standard deviation of reference standard]. This is roughly equivalent to falling at or below the third percentile of the US population. Frisancho (1990) classifies children within age groups as below average if they are at or below the 15th percentile, and above average if they are above the 85th percentile based on US reference data from the NCHS, and we use his standards to evaluate weight-for-height in the children.

A comparison of Yucatec Mayan children’s heights in 1938, 1987, and 1998 revealed significant increases in child growth, especially in the last decade (Leatherman et al., 2000). Yet the increase in height of approximately 2.6 cm between surveys conducted in 1987 and 1998 in Yalcoba is only about half the rate of increase observed for Mayan children migrating to the US (Bogin & Loucky, 1997). The children remain short for their ages compared to US and Mexican standards. Over 65%

Table 4  
Anthropometric assessment of nutritional status in Yalcoba children (1998)

Z-score	N	Percent (%)
<b>A. Height-for-Age in Children 6-18 years (N=456)</b>		
Normal ( $> -2.0$ )	157	34.4
Stunted ( $\leq -2.0$ to $-2.99$ )	208	45.6
Very stunted ( $\leq -3.0$ )	91	20.0
<b>B. Weight-for-height in children 6-11 years (N=224)</b>		
Above Average $> 85$ th percentile	30	13.4
Normal 15.1-85th percentile	192	79.0
Below average $\leq 15$ th percentile	17	7.5

percent of Yalcoba children were stunted in 1998, and 20% were very stunted (Table 4A). In contrast, only about 7.5% were underweight, but 13.4% were classified as overweight based on their weight-for-height (Table 4B).

Thus, while overall child growth has improved in the past decade, levels of stunting indicate that the prevalence of chronic, mild-to-moderate malnutrition remains high; this can be interpreted as an indicator of chronically marginal health and low protein and/or micronutrient status. It appears likely that either poor PQ and/or low zinc bioavailability could be partly responsible for the stunting that persists in association with increased weight gain in the Yalcoba children. The fact that almost twice as many children were above average in weight-for-height as below, suggests that caloric intakes are in excess for some children. However, none of these children were obese, and excessive weight gain in children does not appear to be a problem at this time.

While there is still concern for childhood undernutrition, adult overnutrition, obesity, and diabetes are of major concern in urban settings in the Yucatan (Arroyo, Pardo, Fernandez, Vargas-Ancona, Canul, & Loria, 1999; Dickinson et al., 1993). Dickinson et al. (1993) conducted studies in the vicinity of Merida and report that 86% of urban women are overweight and about 50% are obese. Using slightly more conservative standards, Arroyo et al. (1999) found that 45% of urban Yucatec men and 73% of women are overweight and at or near obesity ( $BMI > 27.8$  and  $> 27.3$ ), and that 2% of men and 12% of women are severely obese ( $BMI > 35+$ ). Moreover, diabetes, a common correlate of obesity, is the fourth leading cause of death in the Yucatan (Arroyo et al., 1999).

As early as 1986, Daltabuit (1988) found a dietary pattern in Yalcoba where younger females had very low intakes of calories and protein, while older women were above standard. We collected heights and weights from clinic records (most from the 1990s), obtaining a sample of 83 adult males and 214 females, and from these

Table 5  
Body mass index (BMI) and overweight and obese adults in Yalcoba

Weight level (BMI)	Percent of males (N = 83)	Percent of females (N = 214)
Underweight (BMI $< 20$ )	8	3
Normal (BMI $\geq 20$ and $< 25$ )	52	33
Overweight (BMI $\geq 25$ )	40	64
Obese (BMI $> 30$ )	10	20

assessed the prevalence of overweight and obese adults. About 40% of the men were overweight and 10% were obese ( $BMI > 25$  and  $BMI > 30$ , respectively); whereas, 64% of the women were overweight and 20% were found to be obese. These levels fall short of those from urban centers in the Yucatan, but begin to approach Mexico City estimates (Arroyo et al., 1999) (Table 5).

The overall pattern of child and adult growth and nutritional status suggests a trend towards what Dickinson et al. (1993, p.315) have described as a double-edged sword of malnutrition: undernourished and stunted children grow up to be obese adults. A fast growing body of literature now links early undernutrition to chronic disease in adulthood (Henry & Uljaszek, 1996). One obvious concern is whether and when growing tendencies toward overweight and obese adults in these communities become associated with the diabetes and hypertension that already plague urban Yucatec Maya. We have no direct evidence to suggest that the rates of diabetes are increasing in Yalcoba. However, diabetes has become a point of local discussions of health. On our last field visit in 1998, two older men told us within the first hour of entering the community that their wives had died in the preceding months, and both identified diabetes as a contributing factor.

## Discussion

The massive penetration of tourism in Quintana Roo and the rest of the Yucatan has irrevocably transformed Mayan environment, economy, society, and culture. We have presented a small slice of what these transformations might bring in terms of diet and nutrition, two important, but little studied, factors in assessing consequences of change. We are *not* arguing that tourism-led development is necessarily a harbinger of either poverty or prosperity, or of improved or worsening health and nutrition. It can be both, largely

depending on how individuals, households, communities, and regions interface with and respond to the sort of economic, cultural, and ecological changes brought about by international tourism. Several studies have argued that those individuals and households who have successfully integrated into the tourist-based market economy are among the best off in rural villages (Kintz & Ritchie, 1999; Dufresne & Locher, 1995). Growth in food markets and increased access to a diversity of products may benefit families with steady incomes and a real living wage. We are impressed that child growth has increased in the past decade. Yet others suffer without access to a steady wage and market foods, and with less local produce available. Moreover, increased consumption of commercial foods also means that a greater proportion of caloric intake is met through sodas and snack foods. This change may prove to be particularly detrimental. Ultimately, the broader pattern of childhood undernutrition and adult overnutrition foreshadows chronic diseases that concern us.

Local residents have little sense of the microchanges in diets that might have occurred over the past 20 years. Nor do they express concerns over dietary change explicitly in terms of health. This is not surprising because for the Maya, and many other cultures, health is but one dimension of an overdetermined web of relationships and realities that are not easily separated out, but rather are interwoven into a broader sense of lived experiences. If we are to adequately problematize the meaning of health and the conditions that produce health differences in such contexts of rapid change, it is important that we broaden our conceptions of health and well-being, as well as the multiple dimensions of change. There are other, and perhaps greater, costs of change in Maya communities, including declining production systems, loss of indigenous knowledge, and an altered sense of identity, community, and family relations. Milpa production has declined, and diets are shifting away from a base in local produce to commercialized foodstuffs. A younger generation of Cancun migrants sees the work of the milpa as crude, “*trabajo rudo*”, and shares little sense with their parents of its importance to the fabric of social and community life. Home gardens are less expansive, less diverse, and less relied upon as a cornerstone for diet. Since foods from these gardens have historically been a major source for vitamins and minerals, and can make up for seasonal shortfalls in the intermittent tourist economy, the dietary and nutritional consequence of this decline warrants further research. Villagers also tie a sense of dietary quality and health to consumption of locally grown corn, beans, vegetables, and fruits. They note the lesser quality and taste of foods they now consume from outside their community, much as they note the decline in milpa as a way of life and the necessity of Cancun to their families’ livelihoods.

The state has strongly promoted regional integration, transportation and market infrastructure, as well as a shared greater national identity via education, social relief programs, and the media. Yet there is a question of priorities for promoting social and biological well-being in these villages. Social welfare programs such as the *Solidaridad* program of President Carlos Salinas invested very little in food-based poverty programs (1%) and health services (7%) (Laurell & Wences, 1994). The rural communities in which we worked had limited access to clean running water and no sewage or sanitation infrastructure, but they did have cable TV service bringing US baseball, *telenovelas* (soap operas) depicting the urban elite of Mexico City, and a barrage of advertisements for food, toys, clothing, and other commodities, and for sun-and-sand tourism. Of course, advertisements for *Coca-Cola* and *Pepsi* appeared with increased frequency amid their cola war, and presented compelling images and reasons to consume their products. These are images difficult to combat. One teacher in Coba told us how nutrition education efforts in the classroom could not compete with Coke and Pepsi commercials. Her students responded to lectures on nutritional education and the ills of junk food with observations that the people on TV drinking coke are rich and successful, and coke cannot be all bad.

In summary, there are indications that while tourism-led economic change has raised economic and some health indicators, it also carries environmental, social, and health costs for many Mayan households. Local populations recognize the potential damage that tourism brings to all aspects of their lives, but also recognize that it brings the much-needed jobs that provide an income to meet the basic needs of their families. As many say, “We would starve without Cancun.”

Perhaps the biggest problem is that the Maya have been granted little input in the planning and development process. They are primarily seen as sources of cheap labor and ethnic backdrop at tourist sites. They are absent from regulatory bodies and middle management strata. It is not too extreme to say that this economic development is transforming the Maya into a peripheral element in their own homeland, a situation that has powerful political and social implications, and complex consequences on health.

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