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Development Transitions in Small-Scale Fisheries – Evaluating Socio-Ecological Impacts of Coastal Tourism Development in the Colombian Pacific

A dissertation submitted in partial satisfaction of the

requirements for the degree Doctor of Philosophy

in Marine Science

by

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ABSTRACT

Development Transitions in Small-Scale Fisheries – Evaluating Socio-Ecological Impacts of Coastal Tourism Development in the Colombian Pacific

by

Karly Marie Miller

Tourism and small-scale fisheries are two of the most important economic sectors in coastal areas, yet the impact of tourism development on fisheries has been understudied within the SSF literature. Within fisheries, the prevailing narrative views tourism as a sustainable development option that will bring socio-economic benefits to the community and reduce pressure on the fishery. In reality, tourism development presents opportunities as well as significant risks to social and ecological dimensions of the fishery but these interactions and possible outcomes are not well documented in the literature. Proactive fisheries management that is designed to accompany and adapt to tourism development is the best way to maximize benefits and minimize risks. However, to anticipate and plan for impacts requires a better understanding of tourism fishery interactions.

This dissertation research explores how tourism development impacts small-scale fisheries – first synthesizing the fragmented literature to develop a conceptual framework, then investigating these interactions through an empirical case study in coastal Colombia. The conceptual framework encompasses the range of potential fishery impacts and identifies

the primary causal mechanisms that create them. Although outcomes vary, this variation is due to difference in contextual factors related to the characteristics of tourism development, sensitivity of the social-ecological system, and mediating or adaptive capacity of local governance. Therefore, the framework can be combined with local knowledge to support more robust site-specific assessments to inform strategic policy and management interventions. This framework increases the legibility of the fragmented literature but also highlights the need for more in-depth study of tourism impacts on fishing livelihoods and resource use.

Within this exiting research, studies document various aspects of tourism-fishery interactions, but it is not clear how they combine to impact total fishing pressure. The addition of alternative livelihoods is widely expected to alleviate pressure on fisheries resources, yet rural development transitions often accelerate exploitation of natural resources. Through a comparative case study of fishing behavior and livelihood engagement in neighboring fishing communities in the Colombian Pacific, I analyze how tourism development impacts community-level fishing pressure, then compare these to tourism impacts on gleaning livelihoods. and consider the implications

Findings indicate that while tourism development leads to a decline in fishery participation, this decline can be more than offset by increases in fishing effort and improvements in fishing methods. This is related to an overall pattern of livelihood specialization and intensification that results in a divergence of household-level fishing behavior — between those that exit the fishery and those that fish more intensively – and an increase in community-wide fishing pressure. However, impacts vary from place to place due to contextual factors in the biophysical environment and socio-political systems that shape

how tourism development affects fishing behavior and whether or not it is likely to benefit sustainable small-scale fisheries.

In contrast to fishing, tourism development is associated with a decline and disappearance of gleaning practices. This highlights important differences within the small-scale fishery sector related to labor practices, livelihood engagement, and the socio-economic role of gleaning and fishing. Collectively, these findings can be used to support place-based assessments in order to anticipate impacts, proactively design fisheries management, and inform more sustainable tourism development planning.

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The long-term sustainability of small-scale fisheries (SSF)[1] have tremendous significance for the socio-economic and cultural wellbeing of coastal communities as well as the health and integrity of coastal ecosystems. Contrary to the assumption that all common pool resources will suffer a tragedy of the commons (Hardin, 1968), many traditional SSF were managed sustainably over long periods of time through advanced regulatory mechanisms based on local knowledge and practices (Ostrom, 2009). However, colonialism, globalization, and neoliberal reforms eroded or destroyed many of these governance systems, and rapidly growing coastal populations, coastal degradation, and increased fisheries exploitation have left many SSF operating at unsustainable levels that jeopardize both the community and coastal ecosystems.

Yet in the face of these concerns, management of small-scale fisheries has proven difficult. Their diversity of gear types, species targeted, and fishing practices make them poorly suited to conventional management strategies. This is exacerbated by a widespread lack of sufficient data to inform management approaches, and limited capacity for monitoring, design, or enforcement of regulations. SSF are also far more embedded in the socio-ecological system of the community than industrial fisheries. They are usually practiced within a constellation of diversified livelihood strategies and can play many roles within a household – providing subsistence, income, cultural identity, and often acting as a safety net (Carter and Garaway, 2014; Kolding, Béné and Bavinck, 2014; Coronado *et al.*,

[1] Though there are numerous definitions, small-scale fishing usually refers to fishing done in near-shore waters by local fishers using smaller vessels, non-mechanized gear types, and manual or lower-powered locomotion. Catches are multi-species and destined for local markets and/or in-home consumption (Chuenpagdee 2012, Teh & Sumaila 2012; Kolding et al. 2014).

2020). They are also disproportionately concentrated in rural areas of the Global South, where livelihood alternatives are limited. This creates resource dependence and restricts fishers willingness and ability to leave a declining fishery (Cinner, Daw and McClanahan, 2009) and makes it both impractical and unethical to restrict fishing through top down management approaches (Allison and Ellis, 2001; Kolding, Béné and Bavinck, 2014; Song and Soliman, 2019).

High resource dependence has been recognized as limiting factor in sustainable management of other resource-based livelihood sectors. This challenge is often met with calls for development in order to create or expand alternative livelihood opportunities (Salayo *et al.*, 2008; Carter and Garaway, 2014). In rural coastal areas where many SSF are located, tourism is the among the most likely and promising avenues for development. Tourism is a massive global sector with exponential growth expected in emerging economies and it is already disproportionately concentrated in coastal areas (Spalding *et al.*, 2017; United Nations, 2017; UNWTO, 2017; Spalding and Parrett, 2019). Tourists are drawn to the natural landscapes and features of rural coastlines, the lack of development and low cost of land and labor are attractive investors and developers, and promise of new jobs, infrastructure, and investment make tourism desirable at the community-scale. National governments often actively promote and encourage tourism development as a way to help integrate rural areas into the national economy and boost the national GDP. Finally, tourism has been widely described and promoted as a form of sustainable development in public and private sectors (UNWTO, 2017).

Related to fisheries specifically, tourism is viewed as a promising avenue to create alternative livelihoods, including ones in marine tourism activities that are well-suited for fishers. It is also frequently linked with marine protected area (MPA) planning and creation because tourism is seen as a way to incentivize conservation and offset economic costs and losses from restricted fishing, while the MPAs are expected to attract more tourists. Tourism-conservation partnerships can also directly fund the creation and/or management of the protected area. However, tourism is also an important driver or rural development transitions that has wide reaching impacts on social, cultural, political, and economic sectors as well as direct and indirect impacts on the environment (Butler, 1980; Miller and Auyong, 1991; Stonich, 1998; Ma and Hassink, 2013; Blumstein *et al.*, 2017; Büscher and Fletcher, 2017; Loperena, 2017).

This dissertation explores the human-environment dynamics of rural development transitions in coastal and marine socio-ecological systems. Research focuses on how tourism development affects livelihoods and marine resource use, and how these changes affect the sustainability and wellbeing of the community and ecosystem.

Organization of the Dissertation

The following chapter brings together literature from across diverse disciplines and methodological approaches to develop a conceptual framework of the diverse ways that tourism can impact social and ecological dimensions of small-scale fisheries and produce a wide range of fishery impacts. The complexity captured in the framework challenges the oversimplified narrative of tourism development as a panacea for management concerns in small-scale fisheries. This chapter describes the causal pathways of tourism-fisheries interactions, beginning with the tourism-related drivers of change, summarizing the range of

possible impacts on small-scale fisheries, and describing the key interaction domains through which these impacts are produced. Findings point to the need for proactive, adaptive fisheries management to develop in step with tourism in order to mitigate new challenges and take advantage of opportunities presented by the shifting circumstances. It underscores the significance of contextual factors in shaping outcomes and the importance of locally informed planning and management processes.

Recognizing the need for place-based empirical research that examines tourism impacts on small-scale fisheries, the last two chapters of the dissertation present findings from a comparative case study of tourism development in seven rural communities on the Pacific Coast of Colombia. This research documents how tourism development leads to a transformation in coastal livelihoods and explore how this affects the long-term sustainability of marine resource use and the socio-economic role of fisheries and gleaning in the community.

Bahía Málaga on the central Pacific Coast of Colombia is an important area for biodiversity conservation and is protected through a mosaic of terrestrial conservation areas and management agreements and the national park which protects the waters in the bay and the surrounding ocean. Afro-Colombian communities have inhabited the area for centuries, subsisting on small-scale, artisanal fishing, gleaning, farming, and logging (see text box 1). However, tourism development in the area has been driving a transformation of the local economy and associated livelihoods. Development has been unequal, largely reflecting differences in accessibility from the urban population center of Buenaventura. This resulted in a spectrum of tourism development among these communities that ranged from little to no tourism development in the most distant communities to well-established tourism and

tourism-dependent economies in the most accessible communities. This heterogenous pattern of development presented an opportunity to study and compare coastal livelihoods and marine resource use in communities at different stages of development to understand the process of development and associated changes at the community-level and to compare between communities to approximate tourism impacts over time.

Research was conducted between 2015 and 2018 and included 14 months of ethnographic fieldwork in the study communities as well as multiple preliminary and follow-up site visits. Alongside development of place-based knowledge through observation and participation in community life, quantitative and qualitative data was collected through interviews and household surveys. Interviews with community members and local leaders explored broad themes of local livelihoods, resource use, patterns of development, and associated change and were used to inform the design of the household survey. Local research was supplemented with meetings with national park officials and staff as well as academic and NGO researchers with experience in the area who provided different perspectives, scale of analysis, and data sources on the region. The household survey was primarily designed to collect information about livelihoods and

Afro-descendent Communities of the Colombian Pacific

Afro-Colombians are recognized as a distinct ethnic group within the 1991 Colombian constitution and the importance of their cultural and socio-ecological practices in the stewardship of these lands and coastal waters was formally recognized in 1993 through Ley 70 which created a legal pathway to collectively title areas long-inhabited by Afro-Colombian in the Pacific region of the country. This created something in between the individually titled lands of the rest of the country and the collectively held sovereign lands within indigenous reserves, where Afro-Colombian communities are not granted sovereignty but are given the rights and responsibilities of collectively managing these territories, most often with little to no support from the national government. Others have written at length about the creation of the law and its implementation throughout the region (e.g., Oslender, 2020) however it is worth noting that despite this legal pathway, the titling process has been heterogenous throughout the region and many areas remain untitled.

resource use, with additional modules on subjective wellbeing and socio-economic status (material conditions, economic security, health, and education), diet and food security, demographics and migration, community cooperation, trust, and governance. It included quantitative, categorical, and open-ended questions that were designed for the specific research or adapted from established survey modules and scales (e.g., HFIAS). The survey was administered to a randomly selected, representative sample of households in each community.

The first empirical chapter examines the relationship between tourism development and small-scale fishing pressure, documenting how, as household livelihood strategies become increasingly specialized, the fishery contracts and intensifies, often resulting in higher fishing pressure. The last chapter then asks the same question but examines patterns of gleaning (marine foraging) and finds that, in contrast to the fishery, gleaning disappears as a livelihood by the late stage of development despite its critical role in households' financial and nutritional resilience during the development transition. Both empirical chapters highlight the major role of local context in shaping outcomes and the importance of accompanying management to realize benefits from tourism-related development. This emphasizes the importance of local knowledge in the planning process and local involvement and ownership in development. Findings challenge the over-simplification of the panacea narrative, but point out that a wide range of development scenarios and fishery outcomes can contribute to the long-term sustainability of the fishery, but only if sufficiently anticipated and planned for.

This work contributes to the growing literature on small-scale fisheries and tourism-fisheries interactions. Through both conceptual and empirical approaches, I demonstrate the complexity and range of tourism development impacts on coastal livelihoods and marine

resource use and argue that development can be beneficial but negative outcomes are common. The ultimate aim is for this research to encourage and facilitate more equitable, just, and sustainable coastal development planning and resource management. In particular, through more widespread consideration of contextual factors and incorporation of local knowledge into policy and decision-making in order to identify opportunities and management interventions to increase the likelihood of socially and ecologically desirable outcomes.

Chapter 2: Conceptual Framework of Tourism Development Impacts on Small-Scale Fisheries

A. Introduction

Small-scale fishing continues to be one of the primary livelihoods in rural coastal areas and is increasingly sharing space with the tourism sector, raising questions about how this development impacts the fishery. Tourism has grown exponentially since the 1950s and has been disproportionately concentrated in Europe and North America, but rapid expansion in coastal areas and emerging economies of the Global South are leading to growing intersections with small-scale fisheries (FAO, 2015; UNWTO, 2017).

The prevailing narrative of tourism-fishery interactions reflects the language of sustainable development, which claims that it is "one of the best positioned economic sectors to drive inclusive socioeconomic growth, provide sustainable livelihoods, foster peace and understanding and help to protect our environment" (UNWTO, 2017, pg. 27). This panacea narrative anticipates that tourism-related livelihoods will lead to reduced dependence and pressure on the resource and ecotourism will help fund and incentivize marine conservation. However, the effects of tourism development have been understudied within fisheries literature and empirical studies focused on tourism-fishery interactions are fairly limited. Even so, findings suggest that tourism-fishery dynamics are more complicated and impacts are more varied than the panacea narrative describes.

Within the broader literature about tourism, coastal development, fisheries, and marine conservation there are many more studies that include empirical "crumbs" – observations or peripheral findings about tourism and fishery interactions. These crumbs are incomplete and

fragmented across disciplines, research topics, and methodological approaches, which limit their accessibility and utility. However, when brought together they can help provide a picture of how tourism interacts with and can impact SSF, revealing a wide range of impacts, both positive and negative. Failure to recognize both possibilities can result in uninformed planning and management, missed opportunities, and unexpected outcomes that could exacerbate existing challenges and jeopardize the fishery.

This chapter presents an empirically grounded conceptual framework of tourism impacts on SSF that reflects the diverse ways that tourism can impact the socio-ecological dimensions of SSF through interaction pathways related to the biophysical, socio-economic, and governance landscapes (Figure 1). The aim of the framework is to increase the legibility of knowledge about these interactions to facilitate more robust place-based assessment, planning, and decision-making related to both fisheries management and tourism development. There is no one-size-fits-all model of development that will ensure benefits, so contextual factors that contribute to divergent impacts are identified and discussed. This is followed by recommendations for how the framework can be used in research, planning, and management to understand, assess, and anticipate how tourism has or may impact fisheries in a given place. The chapter ends with a description of

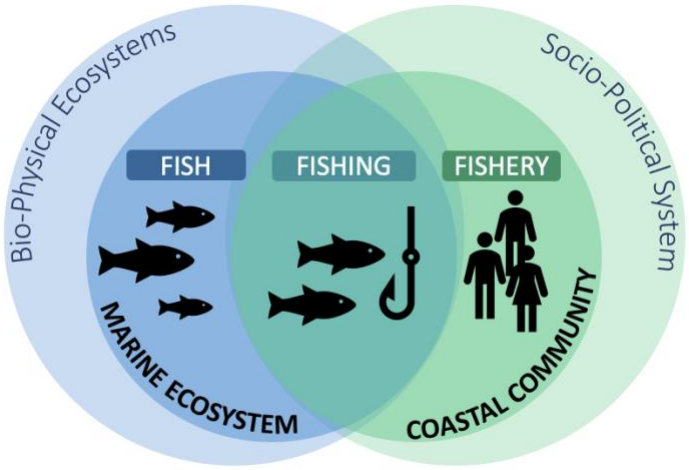

Figure 1: Socio-Ecological System of Small-Scale Fishery

common characteristics of tourism development that emerged from the literature as the most likely to lead to beneficial outcomes for social and ecological dimensions of SSF.

B. Conceptual Framework

Tourism development can be a driver of significant socio-ecological transformations in rural coastal communities, presenting both opportunities and risks for small-scale fisheries. This conceptual framework links empirical research with broader theoretical study of rural development transitions and natural resource management to capture the range of possible tourism-fishery interactions and impacts. The framework is described in three parts, beginning with the tourism-related drivers of change, summarizing the range of possible impacts on small-scale fisheries, and describing the key interaction domains through which these impacts are produced (Figure 2). These interactions are presented linearly, however lateral interactions, secondary impacts, and feedback loops are common within the interconnected socio-ecological system and throughout the development process.

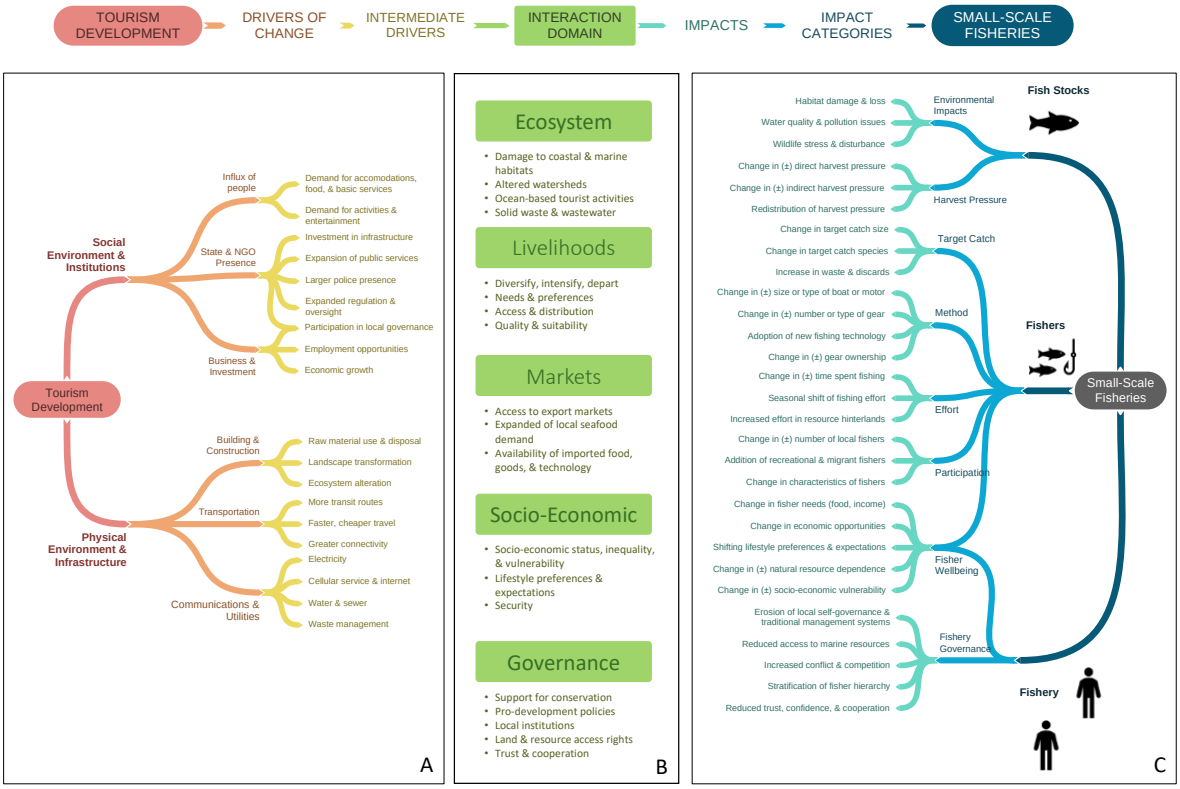

Figure 2: Conceptual framework of tourism-fisheries interactions, including (A) tourism-related drivers of change, (B) interaction domains, and (C) impacts on small-scale fisheries.

1. Tourism-Related Drivers of Change

Tourism development initiates a cascade of changes in the physical environment and social structure of rural coastal communities, driven by an influx of people and expansion of facilities, infrastructure, and services. These drivers are common across diverse contexts but will vary in magnitude and significance depending on the nature of tourism development and will evolve during the different stages of tourism development. The effects of tourism are not limited to the immediate community where development is occurring, so some of the effects will be experienced in neighboring areas (sometimes called “resource hinterlands” in relation to fisheries), and communities experiencing development may have already been affected by development in adjacent areas. It is also important to note that these drivers of change create

a positive feedback loop, through which development-related changes further enable additional development in that community and in neighboring areas, this advancing a development frontier. For example, an influx of people necessitates and provides the capital for physical development, while physical development (of roads, hotels, etc.) enables the arrival of more people. In this way, the drivers of change described in this section can be both products of tourism development and precursors to additional tourism development.

a. Social Environment and Institutions

Tourism involves an influx of short-term visitors and can also include seasonal or long-term visitors and new permanent residents. Tourists' visits are usually short-term and total annual visitors can far exceed the local population once tourism is established, however the number of visitors often vary significantly between high and low seasons and on weekends versus weekdays. Amenity or lifestyle migrants, including expats and retirees, are also attracted to areas with developing tourism and stay for longer periods of time or become permanent residents. Investors, entrepreneurs, and migrant workers come to the area to take advantage of economic opportunities associated with tourism development (Bennett and Dearden, 2014; Mata-Lara et al., 2018). Relative to the local population, amenity migrants, entrepreneurs, investors, and skilled workers are usually from more privileged social groups with better education and access to financial capital, while unskilled workers are often from marginalized populations. The presence of government agencies and non-governmental organizations also increase as development continues, which often leads to an increase in another category of outside professionals, including health care workers, teachers, and police or military, who come on short visits, multi-year posts, or become permanent residents.

b. Physical Environment and Infrastructure

Whether initiated as part of intentional tourism planning or in response to unplanned increase in visitors and local population, tourism development leads to the construction of dedicated tourism facilities (e.g., hotels and restaurants) and expansion of other shared structures (e.g., general stores), infrastructure, and services. Improved transportation infrastructure includes physical roads, bridges, ports, and piers, as well as greater frequency and affordability of public transportation options. Communication infrastructure, related to electricity, cellular coverage, and internet access, as well as expanded banking infrastructure also contribute to greater connectivity and integration with urban centers. Improvements in public health through investment in sanitation services (water, sewer, waste management) and health care facilities can also impact the physical surroundings and local living conditions.

2. Impacts on Small-Scale Fisheries

Tourism development impacts are experienced across the socio-ecological components of SSF, including the *fish* stocks, *fisher* behavior and wellbeing, and the structure and governance dynamics of the *fishery* as a whole. Divergent or contradictory impacts have been documented between locations, changing over time, or experienced among different groups within the same community. Additionally, lateral interactions between impacts are common and can amplify or dampen the net effect on the fishery, so although individual impacts may be considered good or bad, they do not exist on their own and should not be equated with fishery *outcomes*, which is the cumulative result of all impacts in a given place over time.

a. Fish

In Belize, growth of the tourism industry corresponded to a decline in landings of one fish species, suggesting possible benefits for fish stocks (Granados-Dieseldorff, Heyman and Azueta, 2013). However, comparison of reef fish stocks before and after tourism development in the Maldives did not find any significant change (Sattar *et al.*, 2012). Yet, in other scenarios, tourism development has been correlated with declining fish stocks (Aburto *et al.*, 2015), over-exploitation (Key, 2002; Lopes *et al.*, 2015) and direct impacts from increased fishing pressure (Arlinghaus *et al.*, 2016). SSF often target multiple species so tourism impacts may not be consistent across the fishery, and some studies have documented species-specific declines associated with tourism development. However, the multi-species and data-limited nature of most small-scale fisheries makes it difficult to measure changes in stock health and the wide range of possible contributing factors make it difficult to isolate the effect of tourism development, so the majority of studies estimate tourism impacts on fish stocks through proxy measures related to fishing behavior.

b. Fishers

In terms of fishing behavior, tourism development contributes to changes in fishing participation and effort, method, and/or target catch. Declines in fishing participation and effort have been reported as tourism develops (Nayak, Oliveira and Berkes, 2014; Wongthong and Harvey, 2014), but some suggest that reduced fishing locally leads to increased fishing in neighboring areas (resource hinterlands) and/or in distant seas through imported seafood (Lopes *et al.*, 2015; Mas, 2015). There are examples where tourism development was associated with an increase in fishing effort among some fishers (Lopes *et al.*, 2015; Wabnitz *et al.*, 2018). Tourism development has also been associated with the

introduction of new fishing methods through recreational fishing (Arlinghaus *et al.*, 2019), intensification through investment and modernization of fishing methods (Fabinyi, 2010; Haque *et al.*, 2015), as well as simplification as fishers shifted to other livelihoods (Haque *et al.*, 2015). Finally, shifts in fishing season and target catch (by species or size classes) have also been correlated with tourism development (Aburto *et al.*, 2015; Lopes *et al.*, 2015).

Tourism development also affects the economic and dietary contributions from fishing, as well as fishers' relative dependence on the fishery and overall wellbeing. Tourism has led to or been correlated with an increase in income from fishing activities (D'Anna *et al.*, 2016; Wabnitz *et al.*, 2018), though there are also cases where fishery income improves for some fishers and declines for others (Haque *et al.*, 2015). Likewise, dietary contributions may decline for fishing households and/or for non-fishing local residents. Relatedly, and perhaps a more important for fishery management, fishers' dependence on the fishery has been documented or assumed to decline as tourism develops, but under some conditions, tourism can lead to an increase in resource dependence among local fishers. Tourism can also affect other aspects of fisher wellbeing, such as quality of life, household income, safety or risk exposure (Botterill, Seixas and Hoeffel, 2013; Bocarejo and Ojeda, 2016), or marginalization or displacement within the community. Impacts on fishing behavior and fisher wellbeing are related to one another but change in one is not necessarily mirrored by change in another.

c. Fishery

Fishery-level impacts from tourism include changes in fishery composition, governance process, and resource access. Tourism can change the composition of the fishery through changes in local participation as well as the addition of recreational sport fishers (Arlinghaus *et al.*, 2016, 2019) or migrant fishers (Wells, 1997) and expansion of a secondary sector

related to the fishery, such as processors or fish buyers as well as those that provide goods and services for the fishing industry (mechanics, boat repair, sale of ice and gas, etc.).

Tourism also impacts fishery governance, shifting management priorities towards conservation and development and eroding traditional management systems (Alvarado and Taylor, 2014; Bower *et al.*, 2014; Nayak, Oliveira and Berkes, 2014; Aburto *et al.*, 2015; Arlinghaus *et al.*, 2016). Increase in intra- and inter-sectoral conflict over resource access and allocation are frequently documented as well (Bower *et al.*, 2014), however there are examples of tourism leading to increased cooperation within the fishery as well as greater interest in conservation and compliance with regulations among fishers (Diedrich, 2007; Agyare *et al.*, 2015).

Finally, tourism development can also have significant impacts on fishers' resources access due to conservation-related enclosures (Benkenstein, 2013; Bennett and Dearden, 2014) and privatization of coastal areas (Bennett and Dearden, 2014; Nayak, Oliveira and Berkes, 2014; Kadfak and Knutsson, 2017), new (or newly enforced) fishing rules and regulations (), and increased conflict and competition with other fishing and non-fishing sectors (Bower *et al.*, 2014; D'Anna *et al.*, 2016; Arlinghaus *et al.*, 2019).

3. Interaction Domains

Tourism-related drivers of change lead to the range of fishery impacts summarized above through multiple, overlapping interactions pathways. The most prevalent and influential of these pathways can be described within five key interaction domains related to the biophysical, socio-economic, and socio-political landscape. Biophysical changes affect *ecosystem integrity*, impacting fish stocks, and by extension, fishers and the fishery. The majority of tourism impacts are related to changes in the socio-economic landscape –

changes in *livelihoods* and *markets* expand economic opportunities within and outside of the fishery while changes in *cost of living* increase economic need. Collectively these changes shape decisions about fishing behavior, dependence on the resource, and fishers' socio-economic status and vulnerability. Livelihood decisions and the distribution of socio-economic risks and benefits also exist within and reflect the broader *socio-political landscape* in the community, including the balance of power, governance process, and access regulations, all of which are also impacted by tourism development.

a. Biophysical Landscape and Ecosystem Integrity

Habitat damage from construction and development, resource-use and pollution related to growing population, and ecosystem disruption from ocean tourism activities affect ecosystem integrity and contribute to tourism impacts on fish stocks. Construction of buildings and transportation infrastructure (roads, ports, etc.) and landscape-level changes (e.g., beach combing) associated with tourism can increase erosion and run-off, alter watersheds, and damage important coastal habitats (e.g., wetlands, mangroves or seagrass beds, coral reefs) (Driml and Common, 1996; Hall, 2001; Sobhee, 2006; Gladstone, Curley and Shokri, 2013; Gustavsson *et al.*, 2014; Hakim and Retnaningdyah, 2014; Wongthong and Harvey, 2014; Hampton and Jeyacheya, 2015). Pollution and water quality issues often increase with the influx of people, especially in areas lacking formal waste management systems (Wells, 1997; Hall, 2001; Botterill, Seixas and Hoeffel, 2013; Gladstone, Curley and Shokri, 2013; Hakim and Retnaningdyah, 2014; Wongthong and Harvey, 2014; Hampton and Jeyacheya, 2015; Dvarskas, 2017; Gier, Christie and Amolo, 2017), but tourism-related investment and development can create or expand waste management systems leading to a net improvement.

Tourism development has been associated with a risk of invasive species (Hall, 2001; Gladstone, Curley and Shokri, 2013; Arlinghaus *et al.*, 2016).

Ocean-based tourism activities such as scuba diving and whale watching often contribute to wildlife stress and disturbances (Zappes *et al.*, 2011; Gladstone, Curley and Shokri, 2013; Higham *et al.*, 2016; Blumstein *et al.*, 2017) and damage marine habitats from trampling/reef walking, anchor use, and direct contact (Driml and Common, 1996; Gladstone, Curley and Shokri, 2013; Hakim and Retnaningdyah, 2014; Wongthong and Harvey, 2014; Gier, Christie and Amolo, 2017; Wabnitz *et al.*, 2018), while recreational fishing and the curio trade contribute directly to the exploitation of marine resources (Gossling *et al.*, 2004; Gladstone, Curley and Shokri, 2013). In some places recreational fishing accounts for a large share of total catches (Smith and Zeller, 2015) and has contributed significantly to the over-exploitation of certain target species, e.g., Red Snapper in Florida (McClenachan, 2013).

However, tourism development may preclude more destructive and extractive forms of development (Diedrich and Aswani, 2016) or could provide alternative options to help facilitate socio-ecological recovery following significant decline or collapse of the fishery (Stoddart and Sodero, 2015; Gould, 2017). In some cases, tourism contributes directly to conservation efforts such as creating or maintaining MPAs (Brunnschweiler, 2010) and the presence of marine-based tourism has been associated with increased interest in and support of conservation (Diedrich, 2007; Agyare *et al.*, 2015; Hayes *et al.*, 2015; Blumstein *et al.*, 2017). Finally, tourism-related changes in fishing behavior and fisheries management will impact fish stocks and can lead to ecosystem-level changes.

b. Livelihoods

Tourism development expands non-fishing livelihood opportunities in tourism (hospitality, entertainment, and service sector) and related sectors (construction, utilities, public sector, etc.). This influences individual and household livelihood strategies, including how fishers allocate their time, effort, and investment, which impacts fishing behavior and fisher wellbeing. The expansion of livelihood opportunities generally reduces the economic dependence on the fishery and can increase fishers' likelihood to leave a declining fishery (Cinner, Daw and McClanahan, 2009). As fishers reallocate some of the time to these new or expanded livelihood opportunities it can lead to a reduction in fishing participation and/or fishing effort, however this does not guarantee a reducing in fishing pressure.

Changes in the livelihood landscape and economic context also lead to changes in household livelihood strategies. When fishers diversify their livelihoods to take advantage of new opportunities it can result in lower fishing effort and dependence, but new income can also be reinvested in the fishery to facilitate intensification or enable fishers to stay in a fishery that is otherwise unsustainable (D'Anna *et al.*, 2016; Mata-Lara *et al.*, 2018; Ngoc, 2018). This is especially true when the tourism and the fishery have different seasonal schedules, allowing both to be practiced with little effect on the other. Later in the process of tourism development it can also drive livelihood specialization, hastening some fishers' departure from the fishery and increasing fishing effort and intensification among those that specialize within the fishery (Fabinyi, 2010).

Additionally, tourism development introduces new workers to the community. Skilled workers often outcompete locals for higher value positions such as those that require language skills, management experience, or professional certification (dive master).

Unskilled workers drawn by the same new opportunities will also compete in the labor market and may turn to fishing to meet their needs. These new fishers can increase fishing pressure, change the composition of the fishery, increase conflict over resources, and erode local management practices.

c. Markets

Increased local demand for seafood and expanded access to export markets increase economic opportunity within the fishery and motivate greater effort and intensification. Tourism hotels and restaurants are often the largest buyers of local seafood and, alongside demand from the growing population, greatly expand the local market opportunities to sell catches (King, 1997; Aburto *et al.*, 2015; Lopes *et al.*, 2015; Wabnitz *et al.*, 2018). In some cases, hotels and restaurants also pay higher prices for the catch, which can significantly increase the profitability of fishing (Wabnitz *et al.*, 2018). Greater demand and profitability motivate an increase in fishing effort, catches, and income. This tourism-specific demand can also change the seasonality of fishing effort and targeted fish species or sizes(Garcia Rodrigues and Villasante, 2016), for example, favoring larger fish to fillet or plate-sized fish to serve whole, and has been correlated with a decline in certain fish stocks and erosion of traditional management practices (Aburto *et al.*, 2015).

Beyond changes in local markets, improved transportation infrastructure and greater flow of people increases connectivity to distant markets, creating additional opportunities to sell local catches (Benkenstein, 2013) and facilitating increased access to imported goods. The availability of imported food reduces dependence on the fishery and other local means of production, and alongside greater opportunities to sell catches and increased seafood prices, can lead to a reduction or shift in local seafood consumption (e.g., towards lower-value

species) (Gier, Christie and Amolo, 2017). Expanded access to goods and technology, combined with increasing income (from the fishery or other livelihoods), can also facilitate modernization and intensification of fishing methods (Fabinyi, 2010; Haque *et al.*, 2015; Lopes *et al.*, 2017), which result in greater fishing pressure and profits (or can be used to reduce time spent fishing while maintaining catches). Divergence between fishers who can afford to invest and intensify and those that cannot contributes to changes in the structure and composition of the fishery, while expanded market options, access to electricity and refrigeration, and opportunity for profit can lead to the emergence or expansion of secondary sectors within the fishery, such as middlemen and processors.

d. Cost of Living & Socio-Economic Status

Tourism-related increases in the cost of living — caused by price inflation, new expenses, and shifting lifestyle preferences — shape household livelihood decisions and fishing behavior and impact the socio-economic vulnerability and wellbeing of fishing households within the community. Increase in population, in particular of wealthier tourists and investors, increases demand and leads to price inflation and competition for resources (land, water, building materials, food, and other consumer goods) (Bennett and Dearden, 2014; Wongthong and Harvey, 2014; Sroypetch, 2016). Meanwhile, expanded access to public services and utilities (e.g., electricity, water, waste management, as well as health and education[2]), alongside shifting lifestyle expectations and increased availability of imported goods, also introduce new household expenses. Collectively, this leads to rising cost of living and greater need for cash income among local residents.

[2] Occasionally better infrastructure can reduce certain costs, for example electrical stoves may be cheaper than buying natural gas or piped water may be cheaper than buying water from tanks or stores. However, even in these cases, cost of living tends to increase overall.

To meet these needs, fishers increase their catches (increasing effort or improving methods to catch more and/or keeping less catch for themselves) and/or seek supplemental sources of income outside of the fishery, and in some cases may shift to other livelihoods entirely. Some studies suggest that need is a stronger predictor of fishing effort in small-scale fisheries than opportunity (Lopes *et al.*, 2015), so rising cost of living might be a more important driver of increased fishing effort or intensity than expanded market opportunities.[3] If these needs can be met more easily through other livelihoods, fishers who would otherwise prefer to stay in the fishery may be forced to take on other livelihoods or leave the fishery all together.

On the other hand, if these strategies are not enough to keep up with the cost of living, households will experience greater economic stress and vulnerability. This risk is exacerbated by the seasonality of tourism-related economic opportunities (in contrast to the constancy of rising living costs (Wongthong and Harvey, 2014)). Rising costs and land speculation often force these households to relocate to more marginal lands or less desirable areas of the community (Botterill, Seixas and Hoeffel, 2013; Bennett and Dearden, 2014; Nayak, Oliveira and Berkes, 2014). In addition to negative socio-economic and socio-cultural impacts associated with displacement, this can also interrupt households' ability to fish and practice other livelihoods. Rising costs can also have implications for the fishery contribution to local diets as fishers sell more of their catch and higher prices for tourists markets make

[3] This means that increased economic need may be a stronger driver of increased fishing effort than greater market opportunities in the fishery (however greater opportunities would also allow fishers to more easily meet these needs). Fishers that catch only what they need rather than as much as possible may be related to the difficult nature of the work, limited sale options for the catch, or traditional management practices that avoid excess catch, however in cases where depleted fish stocks provide limited opportunity in the fishery, many fishers continue to increase effort in order to meet their needs due to a shortage of other options.

fish less affordable for local non-fishers (Gustavsson *et al.*, 2014; Garcia Rodrigues and Villasante, 2016; Gier, Christie and Amolo, 2017). Already marginalized groups are the most likely to experience increased vulnerability from tourism development, contributing to greater inequality in the community as local elites and outsiders mobilize their social, political, and financial capital to capture the majority of benefits and consolidate their advantage (Arlinghaus *et al.*, 2016). Within the fishery this can this can lead to an increasingly stratified hierarchy, where wealth and power (amassing gear, controlling markets, regulating access) are consolidated among fewer fishers (Haque *et al.*, 2015).

e. Socio-Political Landscape

Elite capture of tourism benefits, the process through which those with more capital are able to invest in tourism and capture the majority of profits, while those who are already at a disadvantage fall further and further behind; along with the influx of outsiders, most of whom have greater financial and political capital than local residents — exacerbates existing inequality. This leads to greater socio-economic stratification within the community and socio-political marginalization of local resource users, especially those with less capital, in planning and management (Bower *et al.*, 2014; Nayak, Oliveira and Berkes, 2014; Arlinghaus *et al.*, 2019). This can contribute to increasing hierarchy and differentiation within fishery, and negative impacts on fishers' socio-economic status and wellbeing, both real and perceived.

In some cases, discussed above, tourism increases household vulnerability, but even where tourism results in a net improvement in socio-economic conditions over time (income, housing conditions, health, and education, etc.), many local households experience a relative decline in their socio-economic status and standing relative to others in the community due to

the unequal distribution of benefits and rapid increase in the presence of significantly wealthier tourists/outsiders. Studies have shown that these relative measures are a better predictor of satisfaction and wellbeing than the real or raw measures, pointing to the connection between relative standing and socio-political power.

As the presence and influence of non-fishing stakeholders (private sector, state agencies, NGOs) increases with tourism, decision-making power shifts away from the local community and management increasingly prioritizes tourism development over local livelihoods and wellbeing (Arlinghaus *et al.*, 2019). New actors contribute additional resources and expertise to local governance and can build local capacity and effectiveness, but often erode local management approaches in favor of more conventional, top-down management strategies (Gossling *et al.*, 2004; Aburto *et al.*, 2015; Gier, Christie and Amolo, 2017). Investors and entrepreneurs, driven by business interests, often seek to privatize land and resources and protect tourism attractions, which can lend political, economic, or logistical support for conservation initiatives such as MPAs in the case of nature-based tourism. State agencies acting to promote and regulate development, conservation, and security, create or extend management, monitoring, oversight, and/or enforcement. Although they may work with the local community to varying degrees, this represents a shift towards more centralized control and decision making. This is often accompanied by increased conflict over access and resource-use between tourism, conservation, and fishing sectors and within the fishery, between small-scale, recreational, industrial.

Materially, these shifts often lead to reduced access and opportunity in the fishery, either through intentional measures of conservation and regulation (Benkenstein, 2013; Alvarado and Taylor, 2014; Bennett and Dearden, 2014; Gustavsson *et al.*, 2014; Hoefle, 2014;

Bocarejo and Ojeda, 2016; Cabral *et al.*, 2018), or as a de facto outcome of coastal privatization and conflict with tourism infrastructure and activities (Alvarado and Taylor, 2014; Bennett and Dearden, 2014; Nayak, Oliveira and Berkes, 2014; Buckley, Guitart and Shakeela, 2017; Kadfak and Knutsson, 2017; Cabral *et al.*, 2018). This can reduce fishing pressure and impacts on fish stocks in the short term, especially when intended as part of conservation planning or resource management. If successful, long-term improvements in fish stocks health will also have lateral benefits for the fishery, however these benefits are often limited, especially when fishers are not included in decision making. When fishers' needs (financial, dietary, cultural) are not considered it reduces their ability and desire to comply. If these conservation measures further marginalize the fishers, it can increase the increase social and ecological vulnerability of the fishery over the long term as fishers are more likely to engage in risky, unsustainable fishing behavior (due both to economic need and lack of ownership and agency/disempowerment in the fishery).

Conversely, tourism development can also improve local socio-political conditions and fishery governance — for example, resulting in formalization of local authority and resource rights, increased management resources through cooperative governance with the state or NGOs, and specific agreements between fishing and tourism sector that do account for fisher needs, allowing for sustainable transition to other marine-based livelihoods or compensating for economic losses from restrictions and closures (Brunnschweiler, 2010).

C. Understanding the Role of Site-Specific Contextual Factors in Divergent Fishery Impacts and Outcomes

The conceptual framework provides an overview of the range of diverse and often contradictory impacts on small-scale fisheries. However, to understand or anticipate which

impacts will be experienced in a given location requires exploration of the role of place-based contextual factors. These local characteristics are especially important shaping the type of tourism development, sensitivity of the socio-ecological system, and mediating factors that affect the interaction pathways, which together can explain much of this variation in impacts and outcomes.

1. Characteristics of tourism development

The type of tourism development affects the magnitude and significance of tourism-related drivers of change. It is characterized by the nature of attractions, size and speed of development, type and number of tourists, source of investments, and distribution of ownership. The type of ecosystem affects what kind of tourism will develop. For example, areas with coral reefs are more likely to attract reef-based ecotourism. This kind of nature-based attractions link tourism with marine ecosystem health and lead to greater interest and investment in conservation, but also increase direct tourism-fishery interactions and the potential for conflict. Healthy ecosystems and fishery resources can also affect what tourism develops, increasing the likelihood of attracting scuba divers and ecotourism, creation more opportunity for sport fishers, and in some cases the fishery itself is part of the attraction (Chiang and Huang, 2012; D'Anna *et al.,* 2016; Chen and Chang, 2017). In contrast, large-scale "sun, sand, and sea" tourism that often develops where there are wide sandy beaches is also a form of nature-based tourism is less dependent on the health or biodiversity of the marine ecosystem and can motivate other forms of environmental degradation (e.g., beach combing or coastal hardening).

The location, accessibility, and extent of infrastructure and public services affect the likelihood of tourism development and the type of tourists likely to be attracted. Remote,

rustic areas are more likely to attract backpackers and ecotourists and experience slower development, while mass tourism is more likely in areas that are better connected to urban centers and can offer a higher-level of services.

Finally, socio-political factors and the regulatory environment can act to facilitate, control, or limit tourism development. For example, unclear or convoluted regulations can add significant hurdles that delay development and make it more expensive, but national governments may offer economic incentives and simplify the regulatory process to encourage large-scale development and attract foreign investors (affecting the size and speed of development and distribution of benefits) or create and enforce regulations and environmental protections that might discourage more socially and environmentally destructive forms of tourism development.

2. Sensitivity of the Socio-Ecological System

Sensitivity of the socio-ecological system affects vulnerability to tourism-related disturbances and likelihood to experience risks or benefits from tourism development and is related to characteristics of the ecosystem, relative isolation of the community, and socio-economic conditions. Fragile ecosystems like coral reefs are more susceptible to physical damage or degraded water quality and fisheries that target highly localized or slow-growing species will be more sensitive to direct environmental changes from tourism. However, these settings could also benefit the most if tourism led to increased protections and interest in conservation and provided economic alternatives that could enable reduced fishing. In comparison, rocky or sandy coastlines with high current flow and fisheries that target abundant, mobile, fast growing species that spawn offshore will be more resilient to tourism-related changes.

Isolated communities with limited local economies will also be more sensitive to tourism-related changes, especially expanded livelihood opportunities and markets connectivity. For example, tourism-related market opportunities will be less likely to impact fisheries that already export catches to larger regional markets and will instead be more likely to be impacted by new opportunities outside of the fishery.

Socio-economic factors also affect how vulnerable the community is, how much it could benefit from tourism, and how benefits are distributed. Low-income communities (high poverty, limited education, food insecurity and limited health care, etc.) often are most in need and stand to benefit significantly from expanded development benefits, but they are also the most vulnerable to exploitation and marginalization associated with tourism due to structural inequality that tends to be amplified by tourism.

3. Adaptive Capacity and Mediating Factors

Interaction pathways are mediated by the context in which they are occurring and can either dampen or amplify tourism-related impacts. Socio-economic and socio-political factors, including the distribution of wealth, power, and influence and characteristics of the governance processes, are particularly important in shaping the timing, magnitude, and direction of impacts as well as the adaptive capacity of the community to respond to and manage tourism development and related changes.

Existing socio-economic and socio-political hierarchies often inform who captures the benefits of tourism (related to who has access to new jobs, more income, better services) and who bears burden of increased vulnerability (higher cost of living/lower relative standing in community, displacement, further socio-political marginalization). Intermediate interactions, especially related to the socio-political landscape, are shaped by the *distribution of power*

and control, which is related to who owns land, resource rights, and tourism businesses; *access and participation*, which is related to how cooperative and participatory local decision making is; *management priorities* – are development goals aligned between local community and outsiders? Are new actors concerned with local needs? What conflicts exist between competing priorities? (e.g., capital investment for the wealthy, community development, opportunities to support conservation); and *relevant experience* with tourism development among those making decisions.

For example, the impact of expanded livelihood opportunities on the fishery depends on the number, quality, and accessibility of new livelihoods. If the new livelihoods are widely available, accessible to fishers, and offer higher economic benefits and/or preferred working conditions, the impact on fishery engagement will be widespread. However, tourism's contribution to new livelihoods may be far fewer than anticipated (Wattanakuljarus & Coxhead 2008). Many of the jobs created are low quality, with long hours, low social status, low or unreliable wages, and/or little opportunity to advance (Sobhee 2006). The higher quality jobs often require more education, language skills, or prior experience, making them difficult for fishers to access. Some jobs related to marine tourism are especially well-suited to fishers (e.g. sport fishing, boat transportation, and wildlife guiding), but in some cases even these can be difficult to access due to safety regulations or permitting requirements (e.g. requiring boats to be permitted for fishing *or* tourism, but not both, Voyer et al. 2018, Lopes 2018).

Perhaps most importantly, local governance mechanisms can shape drivers, interactions, and outcomes, representing the dynamic, adaptive dimension of SES (how much can the system adapt; the other side of the coin on vulnerability). Tourism can lead to capture and

monopolization of decision making (making everything worse), but when locals have legal authority to regulate development and advocate for their needs, planning and management represent avenues to not only shape how tourism develops (so as to minimize harm and risk and maximize benefit in relation to local conditions and needs) but can also act as safeguards to ensure certain protections and distribution of benefits.

The strength and clarity of legal and regulatory environment related to land tenure, resource rights, development restrictions, and environmental protections are major mitigating factors — areas with robust rights, strong local government, and environmental regulations will be better positioned to proactively limit damage, resist appropriations and displacement, and advocate for their needs and interests.

Formal or informal governing processes in the community (including related to fisheries management) can significantly affect a community's capacity to manage, mitigate, and respond to development-related changes (e.g. strong local governance can control or impose regulations on tourism development). Communities with strong local governance, secure land and resource rights, low inequality and high rates of cooperation and trust are the most likely to experience benefits from tourism since the process will be shaped by local needs and priorities, especially if there is prior education and exposure to tourism development to inform decision-making. Where local governance and resource regulation have been eroded or are non-existent/non-functional, the community and ecosystem will be more vulnerable to exploitative development. However, these communities may also have more to gain if tourism helps formalize governance and management (bringing goods and services, increasing safety and oversight, adding economic opportunity, etc.).

The characteristics of tourism development and sensitivity of the socio-ecological system shape tourism impacts and help explain variation, but the dynamic nature of tourism development and the socio-ecological context make it difficult to anticipate outcomes (tourism-related drivers change as development progresses and are not spatially discrete or uniform, and the socio-ecological context also changes throughout development). However, robust planning and management processes often have the greatest influence on tourism-related outcomes in the fishery because they can shape and constrain interactions and adapt throughout the development process. Accordingly, planning and management interventions represent a significant opportunity to increase the likelihood of beneficial outcomes from tourism-fishery interactions. The better we understand these interactions and their interconnectedness, the more likely that we will be able to identify leverage points, even ones that are seemingly remote from the impact or outcome of interest. For example, socio-ecological dimensions rarely considered within fisheries management may be at the root of addressing or avoiding problems that are very much related to fisheries management. Being able to anticipate the range of possible implications of different interventions also makes it less likely that policy and management approaches will lead to unwanted or unexpected outcomes that can exacerbate or create new problems.

D. Opportunities for Policy and Management

While beneficial outcomes are *possible* in any tourism development scenario, smaller-scale, slow growing, locally owned, and cooperatively managed ecotourism focused on attractions related to marine biodiversity will be the most likely to produce tourism-related benefits while minimizing the associated risks. Slower growth allows time for supportive infrastructure and protective regulations to develop alongside tourism (e.g. water treatment

and waste management systems, regulations on where development is allowed). Smaller-scale tourism reduces the extent of disturbance to the community and ecosystem and may result in a higher ratio of high-quality jobs. Marine ecotourism will lead to the most direct incentive to conserve and is less likely to incentivize destructive changes (e.g. removing seaweed and culling sharks for beach-goers comfort). Local ownership is more familiar with and sensitive to local needs and concerns and will retain and reinvest more of the profits within the community, while cooperative ownership results in a broader distribution of these benefits and can reinforce/build community-level cooperation and governance as well.

However, there is no one-size-fits-all model of tourism development that will guarantee desired outcomes in fisheries. These contextual factors highlight the paradox that the communities and ecosystems that stand to gain the most from tourism development are at the greatest risk of exploitative development due to existing vulnerability and need (degraded ecosystems, limited livelihoods, non-existent or non-functional governance, etc.), while communities and ecosystems that are less vulnerable and most likely to benefit already have functional institutions that make them better able to plan and manage development in-line with their needs, values, etc. However, even in communities better positioned to manage tourism, development can erode, co-opt, and corrupt local governance processes, and coastal tourism is developing across wide range of socio-ecological conditions, few of which fit these optimal conditions. Collectively, this highlights that regardless of starting context, the best approach to minimize risks and capture benefits is by supporting proactive, adaptive management designed through a locally-informed assessment and planning process. The next section describes how this framework can be used to help guide that process.

There are opportunities to increase benefits and mitigate risks across multiple scales and sectors through targeted planning interventions and proactive management. At the highest level, evaluating the potential risks and benefits of tourism to inform planning, regulation, and management of tourism development will affect tourism-related drivers of change. If control or regulation of development is not possible, there may be opportunities to influence the interaction domains between tourism and fisheries by supporting the community and local institutions (e.g. support local leaders and governance systems, formalize or protect land and resource rights, protect critical habitats, provide livelihood training, work with tourism operators, or create regulations to encourage fair local employment). Within the fishery proactive and adaptive management can work to mitigate anticipated risks (e.g., modernization of gear and expanded market access) and/or take advantage of tourism-related benefits (e.g. lower dependence on the fishery).

With local knowledge of contextual factors, this framework can be used as a tool to assess the status of tourism-fisheries interactions, anticipate future impacts from tourism development, and, guided by their goals and priorities, identify opportunities to improve benefits and/or mitigate risks through targeted interventions and proactive management. This kind of context-specific planning and management can help maximize the benefits and prevent or mitigate the risks of tourism development in coastal communities. Where tourism development is proposed or ongoing, this framework can facilitate discussion and support decision-making about how to plan, regulate, and manage. Where tourism development has already occurred, it can be combined with local knowledge and existing data to assess how observed impacts were produced, what drivers and interactions were most critical, and to identify possible interventions in tourism development and/or fisheries management that

could improve outcomes in future scenarios. More broadly, this framework can also be used by researchers to identify and investigate specific gaps in existing knowledge and to situate new findings as more research is conducted.

E. Using the Framework to Support Place-Based Planning and Management

Contextual factors shape tourism development, sensitivity of the socio-ecological system, and adaptive capacity of the community are responsible for the variation in outcomes but also present opportunities to influence these outcomes through planning and management interventions. This section provides a step-by-step guide for how the framework can be used in combination with local contextual knowledge as a tool to support place-based assessment, planning, and management.

This assessment can be done quickly as a rapid assessment, over days or weeks, or included within a larger study or planning process. It can be done alone but given the importance of local knowledge and value of cooperative participation, it will be more robust and productive if done among a diverse group of residents, stakeholders, and experts that represent different forms of local knowledge. Building on the principles of transdisciplinary collaboration, the group should identify common goals, establish shared language, and agree on the timeline of the assessment (Eigenbrode *et al.*, 2007).

Before development, the framework can be used to identify the best setting for a certain kind of tourism or the best kind of tourism for a certain location. Where tourism is already developing, the framework can be used to anticipate impacts, identify biggest risks and opportunities, and design interventions (in planning, management, or community support) that could improve outcomes.

If tourism is already developing, start on the left side of the figure with the drivers.

1. Use knowledge of existing tourism to characterize each of these drivers in their community. Then rank in order of significance and impact, considering the frequency, magnitude, scale, etc.
2. Assess the socio-ecological characteristics of the community and ecosystem to identify overall and sector- or class-specific sensitivities, vulnerabilities, and opportunities (See section D).
3. Starting with the most significant drivers, consider how each could lead to a chain of intermediate impacts within each interaction domain.
4. Use existing knowledge of the fishery to anticipate and characterize fishery outcomes.
5. Evaluate anticipated impacts holistically relative to management priorities, considering temporal, spatial, and analytical scales, to identify which are desirable, not desirable, or neutral and then rank in terms of most significant benefits and risks.

   For example, for fishery managers, the possible benefit of better income for fishers may be desirable, but the possibility of significant intensification of fishing or large-scale mangrove destruction may be identified as a higher priority.
6. Identify the spheres of possible action or intervention that are available – what sectors can they influence, what resources do they have, what timeframe are they working with, what is their stated mission, what relationships and partnerships can they draw on?

7. Once these have been identified, start with the top priority outcomes (benefits to maximize and/or risks to mitigate) and work backwards to identify possible leverage points and rank them in order of feasibility.

For example, and NGO may only have ability to influence via gear trade-ins, educational efforts, etc. but can also identify leverage points they could recommend to regulatory agencies or the local community; a community may be able to make decisions about who is allowed to buy property or how they develop it but may not have any capacity to set and enforce rules in the fishery).

If tourism is not yet developed, flip the process to begin on the right side of the figure, with SSF impacts, to identify the biggest challenges or risks in the fishery and articulate and prioritize the goals for tourism development.

Minimally, the framework helps create a structure to think through these interactions, and if done collaboratively, can facilitate knowledge exchange and co-generation. Ideally, it helps to inform more targeted and advantageous planning and design of proactive management and/or supportive interventions that could help prevent or mitigate risks and improve wellbeing and sustainability in the fishery.

F. Conclusion

Tourism development impacts fisheries through dynamic interaction pathways that are shaped by site-specific context and can result in divergent or contradictory fishery outcomes. The conceptual framework presented here seeks to make the complexity of tourism-fishery interactions more legible and improve access to the existing knowledge about how fisheries impacts occur. Literature supports tourism's potential to benefit fisheries, but these benefits aren't guaranteed, and tourism can also lead to significant negative outcomes across the

socio-ecological dimensions of the fishery. Failure to acknowledge the risks as well as benefits can leave the fishery especially vulnerable, but there are also opportunities throughout the development process to maximize the benefits and mitigate the risks through development planning, community-level interventions, and proactive, adaptive fisheries management. This framework can be used as tool to facilitate and support more robust assessments of likely outcomes in a given location, drawing on the users place-based knowledge to identify opportunities and prioritize how, when, and where to invest resources to increase the likelihood of benefits for the fishery.

While we can draw some generalizable conclusions from this review and framework about when tourism is most likely to lead to beneficial outcomes, a number of key questions remain and should be a priority in future research in order to better understand how tourism and fisheries can be best managed together for mutual benefit and long-term sustainability. More research is needed to better understand tourism-fisheries interaction pathways, how they are shaped by contextual factors, and to examine the potential of different management approaches to shape these outcomes. This should be done through transdisciplinary, mixed methods research in collaboration with local stakeholders and across a broader diversity of spatial, temporal, and analytical scales and tourism contexts.

Chapter 3: Disentangling Tourism Impacts on Small-Scale Fishing Pressure

A. Introduction

Small-scale fisheries (SSF)[4] are important to people and the environment – over 90% of fishers are in the small-scale sector, and in rural areas of the Global South where SSF are predominantly located, it is often one of the primary livelihoods and sources of food and income in rural coastal communities (Allison and Ellis, 2001; Béné, 2006; Kawarazuka and Béné, 2010; Rockefeller Foundation, 2013; Teh and Sumaila, 2013; FAO, 2015; Golden *et al.*, 2016). Harvests from SSF account for two-thirds of all seafood for human consumption and up to half of global fishery catches and it can be an important driver of ecological changes in near shore environments (Chuenpagdee *et al.*, 2006; Kelleher *et al.*, 2012; Benkenstein, 2013; FAO, 2015, 2020; Zeller *et al.*, 2015). Growing coastal populations, overharvesting, environmental degradation, and climate change threaten the long-term sustainability of many small-scale fisheries. However, conventional management approaches are limited and high dependence on fisheries resources constrain fishers' willingness and ability to reduce fishing or leave the fishery (Allison and Ellis, 2001; Cinner, Daw and McClanahan, 2009; Kolding, Béné and Bavinck, 2014; Singleton *et al.*, 2017; Song and Soliman, 2019). In these settings, the expansion of alternative livelihoods through economic

[4] Small-scale fisheries encompass a diversity of fisheries and can vary from region to region. For the purposes of this paper, I follow Teh and Sumaila (Teh and Sumaila, 2013) who characterize small-scale fisheries as "(i) primarily geared towards household consumption or sale at the local level; (ii) conducted at a low level of economic activity; (iii) minimally mechanized; (iv) conducted within inshore areas; (v) minimally managed; and/or (vi) undertaken for cultural or ceremonial purposes." For more in-depth discussion see Béné (2006, pgs. 5-6) and Chuenpagdee *et al.*, (2006, pg. 10).

development is viewed as an avenue for resource conservation (Salayo *et al.*, 2008; Cinner, Daw and McClanahan, 2009; Carter and Garaway, 2014).

Tourism is among the most likely and promising forms of development in rural coastal areas because it is a massive global industry that already has a major presence in coastal areas (Spalding *et al.*, 2017; United Nations, 2017; UNWTO, 2017; Spalding and Parrett, 2019). Coastal tourism develops in part because of the natural attraction of coastlines, especially throughout the tropics, and rural areas are attractive because they provide a contrast to urban areas where most tourists come from, and the low cost of land and labor are attractive to developers. Tourism development is viewed as a form of sustainable, non-extractive development, and helps expand infrastructure and services that link rural regions with national economies, making it attractive to national governments and local communities alike. But, it is also an important driver or rural development transitions that has wide reaching impacts on social, cultural, political, and economic sectors as well as direct and indirect impacts on the environment (e.g., Butler, 1980; Miller and Auyong, 1991; Stonich, 1998; Ma and Hassink, 2013; Blumstein *et al.*, 2017; Büscher and Fletcher, 2017; Loperena, 2017). In this context, the question of how tourism-related development transitions impact small-scale fisheries (participation, practices, pressure, and importance) is of particular importance but has been understudied in both tourism and SSF literatures (Cohen *et al.*, 2019).

1. Sustainable Livelihoods and Rural Development Transitions

Sustainable livelihoods approach and later framework (Chambers and Conway, 1992; Ellis, 1998; Scoones, 1998, 2009, 2015) were developed to study and better understand rural development impacts on people and resource use, and though initially focused on agrarian

systems they have also been widely applied to the study of fisheries and coastal livelihoods (Ferrol-schulte *et al.*, 2013). This approach identifies three primary adaptive livelihood strategies – described as intensification and extensification, diversification, or migration – and recognizes various factors that shape livelihood decisions and outcomes, including socio-ecological context, livelihood resources, and institutional/structural responses.

In agrarian systems, rural development transitions are commonly associated with a pattern of intensification and/or extensification of production, motivated by expanded access to markets as transportation infrastructure improves (VonThünen, see (Peet, 1970)), and through investment in modernized and/or mechanized equipment that can accelerate or expand production and harvest. This is less common with tourism-related development transitions, which instead are often associated with a pattern of livelihood diversification and a shift away from agriculture and natural resource-based livelihoods due to the pull factor of new tourism-related livelihood opportunities and push factor as land is purchased and converted for tourism or set aside for conservation, which changes land use patterns and can displace farmers (e.g., Burbano, Meredith and Meredith, 2020; Li, Bai and Alatalo, 2020). Both scenarios are often associated with a progressive concentration of land and wealth and marginalization and displacement of those unable to capitalize on development. This displacement can result in migration-based strategies, but to the extent that tourism increases livelihood opportunities it may reduce out-migration from rural areas.

2. Tourism Interactions and Impacts in Small-Scale Fisheries

In coastal areas where tourism is already developed, there are direct and indirect interactions with small-scale fisheries that change fishing behavior, including who fishes, how often, and with what kind of gear (Hampton and Jeyacheya, 2015; Ngoc, 2018). The

link between tourism development and declining fishery participation is the most widely documented and consistent impact. Evidence supports the expectation that fishing participation will decline as tourism develops and fishers shift away from fishing in favor of tourism-related livelihood alternatives (Fabinyi, 2010; Granados-Dieseldorff, Heyman and Azueta, 2013; Wongthong and Harvey, 2014; Mas, 2015; Su, Wall and Jin, 2016; Ngoc, 2018). Declining participation in the fishery is also driven by tourism-related development that leads to displacement or limits access to the fishery. This is related to development and privatization of the coasts (i.e. tourist-only beaches), spatial conflicts with marine tourism activities like scuba diving and whale watching, and conservation enclosures that prohibit fishing (i.e. marine protected areas) (Young, 1999; Oracion, Miller and Christie, 2005; Brondo and Woods, 2007; Cabral and Aliño, 2011; Alvarado and Taylor, 2014; Bennett and Dearden, 2014; Nayak, Oliveira and Berkes, 2014; Bocarejo and Ojeda, 2016; Higham *et al.*, 2016), including isolated cases where tourism-conservation initiatives pay fishers not to fish in certain areas (Brunnschweiler, 2010; Biggs *et al.*, 2016).

However, tourism is not always associated with a decline in fishing participation, even among fishers that diversify their livelihoods (Sievanen *et al.*, 2005; Hill *et al.*, 2012; Carter and Garaway, 2014; Haque *et al.*, 2015; Burbano, Meredith and Meredith, 2020; Pham, 2020), and recreational sport fishing can even add new fishers (McClenachan, 2013; Bower *et al.*, 2014; Salmi, 2015; Arlinghaus *et al.*, 2016; Chen and Chang, 2017). Tourism also creates local demand for seafood, which has been associated with increases in fishing effort, fishing income, and unsustainable harvest practices (King, 1997; Sattar *et al.*, 2012; Lopes *et al.*, 2015; Smith and Zeller, 2015; Garcia Rodrigues and Villasante, 2016; Wabnitz *et al.*, 2018). Even where tourism was accompanied by increased conservation measures and an

apparent decline in fishery participation, there were reported declines in certain reef fish associated with restaurant demand (Aburto *et al.*, 2015; Ngoc, 2018). There are fewer studies that document changes in fishing methods alongside tourism development, but fishers may simplify their gear as they diversify their livelihoods, though intensification resulting from investment in larger boats and motors has been documented more often and sometimes is directly related to the ability to use boats for fishing and tourism (Sievanen *et al.*, 2005; Fabinyi, 2010; Carter and Garaway, 2014; Haque *et al.*, 2015; Lopes *et al.*, 2017).

Changes in fishing behavior – participation, effort, and fishing method – are important measures on their own to understand how the fishery and its socio-economic contributions are changing. However, all three must be studied together to understand how tourism impacts total community wide fishing pressure, which is an important metric that can be used as a proxy for fishing mortality or to estimate total catch[5]. There have been very few studies that directly examine tourism-related impacts across all three dimensions to estimate the net effect on community-wide fishing pressure, but the literature provides evidence of a range of fishery impacts and divergent outcomes, both between and within communities and possibly at different stages of development (e.g., study of fishing and tourism in the Balearic Islands between 1940 and 2010 (Mas, 2015)). Some evidence, especially related to participation, suggests that fishing pressure and fishing mortality is likely to decline as tourism develops

[5] Fishing mortality refers to how many fish are removed from the ecosystem as a result of fishing and is a key factor in establishing sustainable harvest levels. However, accurate data on fishing mortality is difficult to collect so fishing pressure is often used as a proxy measure. Fishing pressure combines data on the number of fishers, how often they fish, and what methods they fish with to estimate total fishing mortality. Participation and effort are combined to measure total fishing days per month in the community for each fishing method. The average daily catch for each fishing method is used to estimate catch per unit effort (CPUE). The sum of CPUE times the total effort for each method can thus be used estimate total catch and fishing mortality associated with the community over a day, month, or year.

(Granados-Dieseldorff, Heyman and Azueta, 2013; Wongthong and Harvey, 2014; Su, Wall and Jin, 2016), however tourism-related seafood demand, changes in fishing method, and continued overfishing raise questions about whether tourism development can also lead to an increase in fishing pressure (Mas, 2015; Wabnitz *et al.*, 2018). This underscores the need to better understand not just how but also when and why tourism development impacts fishing behavior and fishing pressure, and what causes divergent outcomes.

This paper seeks to address these questions through a comparative study of livelihoods and fishing behavior in seven neighboring communities at different stages of tourism development, where differences are used to assess the patterns and processes of tourism impacts on fisheries across development stages and to explore community-level dynamics that shape fishery outcomes. In light of expanding tourism and ongoing challenges in sustainable management of SSF that threaten communities and ecosystems, this study contributes important insights into how tourism-driven development transitions in coastal and marine ecosystems affect fishing pressure through impacts on fishing behavior – including participation, effort, and method. More broadly, it adds to a growing body of literature on coastal and marine livelihoods and the role of tourism in rural development transitions. By studying tourism impacts across multiple dimensions of fishing behavior and in relation to community livelihoods findings from this study can be used to help inform targeted fishery management and more strategic tourism development planning, including anticipating negative impacts and associated risks and identifying opportunities to increase tourism benefits.

B. Research Design and Study Communities

These questions are examined through a comparative case study of seven neighboring communities in the Colombian Pacific that had varying degrees of tourism development. Each community provided a snapshot of fishing engagement at a different point in the development process, creating an opportunity to use differences between communities to estimate how tourism development impacts small-scale fisheries over time. This approach is similar to the space-for-time substitution method used in the natural sciences (Pickett, 1989), but here distance is measured in terms of accessibility (difficulty, time, and expense), which is a critical determinant of the timing and extent of tourism development (Khadaroo and Seetanah, 2007).

Tourism development is a continuous process but passes through identifiable stages, simplified here into early, middle and late (from the five stages originally described by Butler (Butler, 1980), see Appendix A). Each of these stages was represented by multiple study communities, so differences between *stages* of tourism development were used to identify more generalizable patterns, and differences between *communities* provided additional analytical nuance and insights into when and how impacts occur. The early stage is characterized by small numbers of infrequent tourists, tourism amenities are limited and primarily provided by residents, and there is relatively little social, economic, or environmental impact. The middle stage is a period of rapid growth, when a steep increase in the number of tourists leads to noticeable changes in physical space and social norms and locally provided facilities are replaced by larger, more elaborate facilities often owned by outside organizations. In the late stage, tourism is a major part of the local economy and visitor numbers equal or exceed residential population, at which point it can strain local

resources, interfere with non-tourism-related activities, and lead to social, economic, and/or environmental problems.

1. Study Communities

The seven study communities are located in and around Bahía Málaga on the Pacific Coast of Colombia. The area is only accessible by boat from the port of Buenaventura, approximately 24 miles to the south, and like much of the pacific region, infrastructure is underdeveloped and access to basic amenities is limited (Arboleda Home, 1993; Cantera Kintz *et al.*, 2013). The population is primarily Afro-Colombian and share similar socio-cultural traditions and resource-use practices.[6] Three communities, Juanchaco, Ladrilleros, and La Barra, are situated near the mouth of the bay facing the ocean (beachfront) and can be reached by daily ferries between Juanchaco and Buenaventura. The other four communities, La Plata, Miramar, La Sierpe, and Mangaña, are located in the interior of the bay (bayside) and are only accessible by private boat (Figure 3). In 2010 the bay and surrounding ocean were declared a National Park to protect the exceptional biodiversity and humpback whales that come to calve and breed in the bay (INVEMAR, UNIVALLE and INCIVA, 2006; Florez-Gonzalez *et al.*, 2007; Ministerio de Ambiente Vivienda y Desarrollo Territorial, 2010; Cantera Kintz *et al.*, 2013).[7]

These communities have traditionally depended on fishing and other natural resource-based livelihoods (gleaning, farming, logging, and hunting) but more recently tourism has become the major economic sector in the region. Fishing and tourism in Bahía Málaga are

[6] Surveys were collected in an eighth community but excluded from analysis due to insufficient data.

[7] Parque Natural Nacional Uramba Bahía Málaga protects 47,094 marine hectares of the ocean, bay, islands, and coastline, and represents 25.88% of the Buenaventura Ecoregion.

both small-scale and largely unregulated. Fishing is done alone or in small groups from canoes or open-deck boats with small outboard motors. Hand lines, long lines, and various nets are used and catches are consumed at home or sold locally (Appendix B) (Caicedo Pantoja, Zapata Padilla and Roldán Ortiz, 2008; Chaves Lozada, 2014; Tilley and Box, 2014). Tourism development accelerated following the construction of a pier in Juanchaco and the beginning of ferry services in 1992. Whale watching began in 1994 and is the most important attraction alongside beaches, waterfalls, and nature tours. Approximately 12,000 tourists visit the region annually, the majority coming from within Colombia during the whale watching season (July-Oct) and around Christmas, New Year, and Easter holidays (Avila, Correa and Parsons, 2015). Tourism amenities include family- or community-owned restaurants and guest houses and small to mid-size hotels that are mostly owned by Colombians from cities in the interior of the country. Tours, transportation, and other services are provided by locals and, aside from limited employment in the public sector, the majority of livelihoods are informal.

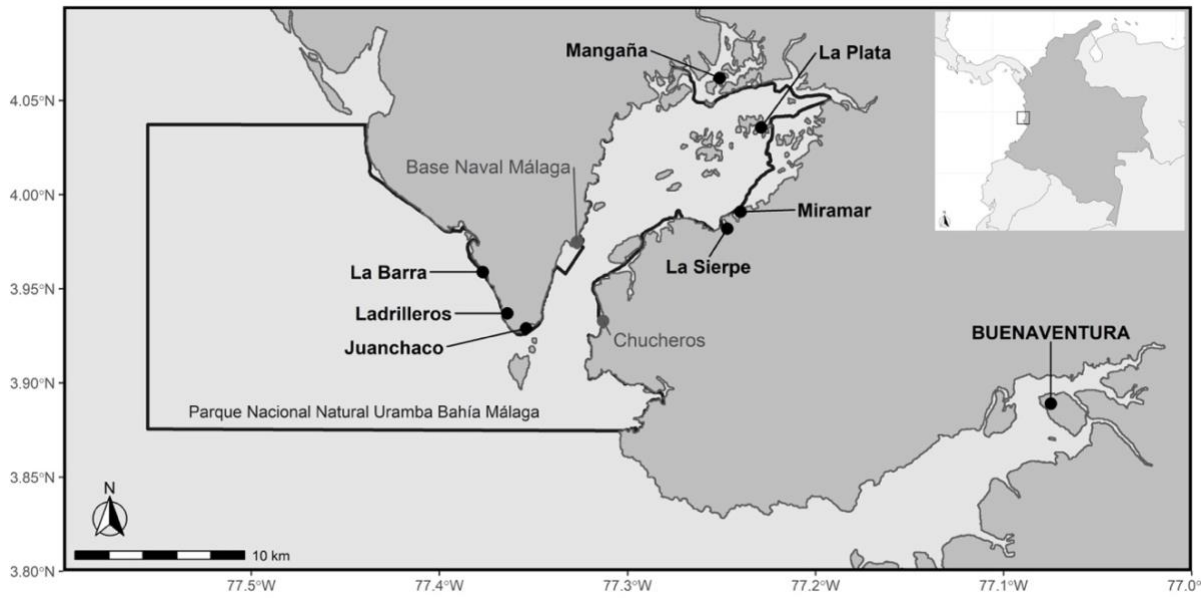

Figure 3: Map of study region and communities in Bahía Málaga, Valle del Cauca, Colombia

The seven communities were categorized into the three tourism development stages according to their development history and characteristics of tourism at the time of research (Figure 4, Table 1) (Zuluaga Garcia, 2014). Mangaña, La Sierpe, and Miramar were in the early stage of tourism development, La Plata and La Barra in the middle stage, and Ladrilleros and Juanchaco in the late stage. Mangaña had the least developed infrastructure and effectively no tourism, while La Sierpe and Miramar had basic facilities, but visitors were infrequent. La Plata and La Barra were both in a period of tourism growth. Tourism was younger and faster-growing in La Plata where a community-owned, cooperatively managed eco- and ethno-tourism company was started in 2008 and operated two guest houses, a restaurant kiosk, and various ecological and cultural tours and activities (Lobo, Velez and Puerto, 2016). Tourism began in La Barra earlier than La Plata due to its proximity and accessibility from Ladrilleros and Juanchaco, but unlike those communities, amenities were only provided by local families and included camping shelters and rented rooms, beachside restaurant kiosks, and informal guided tours. Ladrilleros and Juanchaco received the most tourists and had the most extensive and developed infrastructure and amenities, including hotels, restaurants, bars, and stores. Ladrilleros had the greatest extent and diversity of tourism amenities, with accommodations ranging from small hostels to higher-end mid-size hotels. Juanchaco had fewer hotels than Ladrilleros but was the primary departure point for whale watching tours and, as the central transit hub and largest community, had more public services (health, education, police, banking) and infrastructure than other communities.

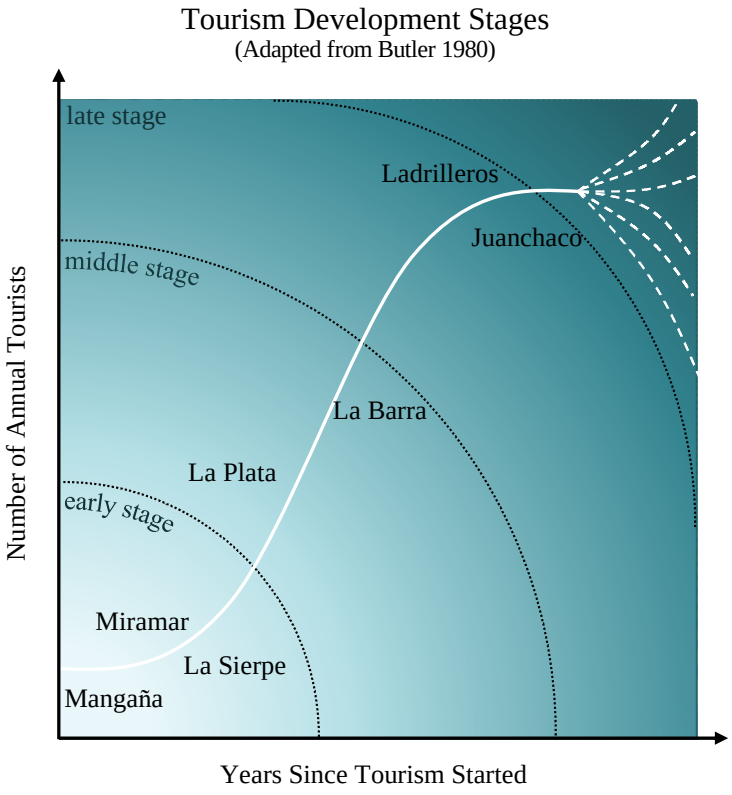

Figure 4: Tourism development stage in study communities.

Table 1: Community access, infrastructure, and status of tourism development

Community	Location	Infrastructure & Services	Travel Time & Access from Buenaventura	Tourism Development		
				Development Stage & Butler's Stage		Approx. decade of arrival, growth pattern, amenities (accommodations, restaurant, guides), % of households involved in tourism
Mangaña	Bayside; island	Primary school (k-3), Internet café Private generators	~3 hours; private boat from Juanchaco via La Plata (+90 min)	EARLY STAGE	Exploration	• No consistent presence at time of research • Estimated annual visitors on order of 10s • No lodging or tourism facilities • 0% household participation in tourism
La Sierpe	Bayside; bluff	Primary school (k-3), Internet café Private generators, Floating dock	~2.5 hours; private boat from Juanchaco, often via La Plata		Involvement	• Began in 2000s, not yet had period of growth • Estimated annual visitors on order of low 100s • Community-owned guest dormitory (7 rooms, 28 beds); no restaurants • 6% household participation in tourism
Miramar	Bayside; bluff	Primary school (k-3), Internet café Private generators, Floating dock	~2.5 hours; private boat from Juanchaco, often via La Plata		Involvement	• Began in late 2000s, not yet had period of growth • Estimated annual visitors on order of low 100s • Private homestay (4 beds), small restaurant, community-owned hotel (under construction) • 10% household participation in tourism
La Plata	Bayside; island	Primary school (k-6), Internet café Community generator, fixed/floating pier	~2 hours; private boat from Juanchaco	MIDDLE STAGE	Development (early)	• Began in late 90s/2000s, formation of cooperative in 2008, entered significant period of growth in 2010s • Estimated annual visitors on order of mid 100s • Community-owned guest dormitory (6 rooms, 24 beds) and guest house (3 rooms, 8 beds), private homestay (4 beds); community restaurant; certified ecotourism guides • 60% household participation in tourism
La Barra	Beachfront; beach & estuary	Primary school (k-6), internet cafés, electricity	~2 hours; by land from Juanchaco		Development (late)	• Began in 70s/80s with development in neighboring Ladrilleros, entered period of growth in 90s that continued through 2000s and 2010 but showed signs of early consolidation at time of research • Estimated annual visitors on order of high 100s/low 1000s • Hostels, family guest rooms, camping shelters; open-air restaurant kiosks • 92% household participation in tourism
Ladrilleros	Beachfront; bluffs	Primary school (k-6), internet cafes, National Park office, electricity	~1.25 hours; by land from Juanchaco	LATE STAGE	Stagnation	• Began in 60s/70s, significant development in 90s, consolidation in late 2000s/early 2010s • Visitors on order of 1000s annually • Numerous hotels (10-40 rooms each), hostels, and guest houses; Hotel dining, family-owned restaurants, beach vendors, general stores; National Park Office, trained & informal guides • 77% household participation in tourism
Juanchaco	Beachside; beach & bluffs	Secondary school (k-11), internet cafes, medical clinic, money wire services permanent pier, electricity, aqueduct	~1 hour; ferry from Buenaventura		Decline/Rejuvenation	• Earliest tourism in 60s and 70s, significant growth in the 90s (pier and whale watching), consolidated in 2000s and developed diversified economy in 2010s (fewer overnight tourists, but everyone passes through for transportation and whale watching) • Annual tourists on order of 10,000s but many then stay in other communities • Small to mid-size hotels and hostels (11, 2-10 rooms each); hotel dining, restaurants, bars, general stores; National Park whale watching guides and boat operators • 58% household participation in tourism

2. Data Collection

Research was conducted between 2015 and 2018 and included initial site visits, 14 months of ethnographic fieldwork including interviews and household surveys, and follow-up site visits. The in-depth household survey was designed to collect data about livelihood engagement, fishing behavior, and other forms of natural resource use, with additional questions about diet and food security, socio-economic status, subjective wellbeing, cooperation, and governance (survey available in Appendix C). Interviews were conducted with community members (males and females of different ages) to inform the design and language of the survey and it was reviewed by local leaders and piloted in the beachfront communities before data collection began. A research assistant from each community was trained to administer the survey and worked together with the author to collect a total of 208 surveys from across the seven communities between June and September 2016 (Table 2). In order to select a random sample of households, field censuses were conducted in each community. The census was provided by local leaders in the bayside communities and produced through GPS field census in the larger beachside communities. A random number generator was used to assign all households a number between 0 and 1, and households were sampled from lowest to highest with the goal to survey at least 20% of the community, or at least 20 households in communities with less than 100 households). Households that declined to participate or were unavailable after multiple visits were replaced by the household with the next highest number on the list. All households were surveyed in the three smallest communities, but some were away from the community during the survey period. Survey data was summarized and shared with individuals and leaders in each community during

follow-up field visits in 2017-2018 to evaluate its accuracy and elicit additional feedback and clarification.

Table 2: Household Surveys. Within each household, survey respondents answered questions about the livelihood activity for each working individual, included in seventh column. The total number of livelihoods reported by households within each community is included in the last column.

	Community	Households		Percent Surveyed	Response Rate	Individual Livelihood Surveys	Total Reported Livelihoods
		Total	Surveyed				
Early Stage	Mangaña	16	14	88%	100%	23	9
	La Sierpe	19	17	89%	100%	35	12
	Miramar	23	20	87%	100%	46	16
Middle Stage	La Plata	44	20	45%	100%	41	18
	La Barra	68	24	35%	92%	64	19
Late Stage	Ladrilleros	180	60	33%	90%	121	27
	Juanchaco	250	53	21%	87%	95	20
Early Stage		58	51	88%	100%	104	18
Middle Stage		112	44	39%	95%	105	21
Late Stage		430	113	26%	89%	216	28

3. Data Analysis

In order to understand the relationship between tourism development and small-scale fisheries, household survey data were used to evaluate household participation in fishing and other livelihood sectors at the community-level, data from fishing households were used to characterize fishing behavior, and these measures were combined to estimate community-wide fishing pressure. Qualitative data from ethnographic field work was synthesized at the community-level to identify causal mechanisms (e.g. causal process observations (Dunning, 2012)) and site-specific factors that might have shaped these interactions and contributed to observed differences.

Community-wide livelihood participation is the percent of surveyed households that reported engaging in each livelihood within the past 12 months. *Fishing effort* is the average

number of fishing days per month reported by fishing households. *Fishing power* reflects the relative efficiency of different fishing methods and is described in five levels, ranging from low to high. Fishing households were categorized into these levels based on the largest vessel type and highest motor power reported. Fishers used similar gear types throughout Bahía Málaga, so gear was not included in fishing power categorizations (Appendix D). *Catch coefficients* represent the difference in average daily catch for each power level and were calculated relative to the medium-low power category.

Household-level fishing pressure is calculated by multiplying fishing effort times the catch coefficient associated with fishing power, resulting in adjusted household fishing-days per month, which can be greater than 30. This reflects the effect of power level on daily catch potential and can be used as a proxy for fishing mortality since, holding the ecosystem and stock health constant, total catches scale with total fishing pressure. *Community-wide fishing pressure*, which is the sum of household fishing pressure divided by the total number of surveyed households in each community, accounts for differences in participation rates and can be compared between communities of different sizes. *Livelihood diversity* reflects the number of livelihoods reported by each working individual over the past 12 months and the *importance of fishing livelihoods* indicates the relative rank of fishing compared to other livelihoods.

C. Results

1. Tourism Impacts on Fishing Behavior

Comparison of fishery participation, fishing effort, and fishing power across the seven communities in Bahía Málaga reveal distinct differences in patterns associated with the early, middle, and late stages of tourism development.

a. Community-Wide Fishery Participation

As predicted, the late stage of tourism development was associated with lower participation in the fishery (Figure 5). In the late-stage communities, 32% of surveyed households participated in the fishery, which was less than half of the 76% of households in early-stage communities and 80% in middle-stage communities, suggesting that fishery participation declined by over 50% between the early and late stage of tourism development. Furthermore, data on household livelihood participation across the seven communities support the finding that this difference in fishery participation is related to a transition from primarily natural resource-based livelihoods to tourism sector livelihoods. In the early-stage, households engaged in a range of natural resource-based livelihoods with little to no participation in tourism, compared to late-stage communities, where tourism-related livelihoods dominated. High rates of participation across sectors in the middle-stage indicate a transition period that is discussed in more detail below in Section C.3.

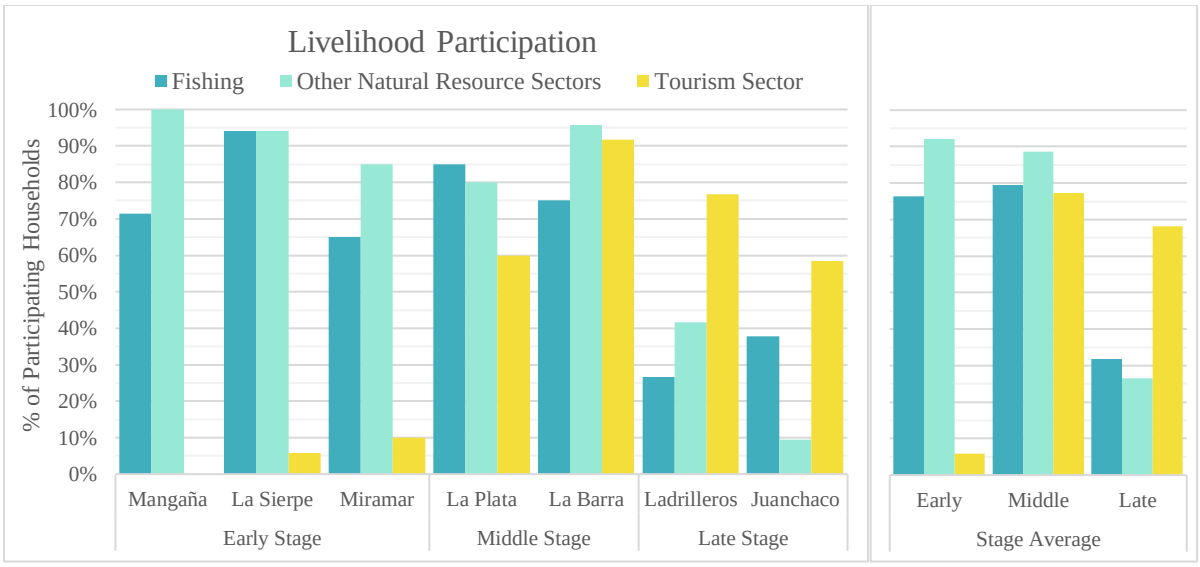

Figure 5: Percent of household participation in fishing, other natural resource sectors (logging, gleaning, farming, hunting, animal husbandry, and gravel mining), and tourism sector. See Appendix D for participation in all livelihood sectors.

b. Fishing Effort

Unlike participation in the fishery, average fishing effort – measured only among fishing households – increased across the spectrum of tourism development (Figure 6). Fishing households in early-stage communities reported an average of 9.1 fishing-days per month, which increased to 13.7 in the middle stage and 16.6 in the late stage. In Juanchaco, fishing households reported an average of 26.9 fishing-days per month, nearly three times higher than the early-stage communities. Ladrilleros was the exception to the overall pattern, with the lowest average effort in Bahía Málaga. This was related to coastal erosion in the 1990s that reduced access to the fishery and led to a significant decline in fishing, which will be discussed in more detail in Section D.2.

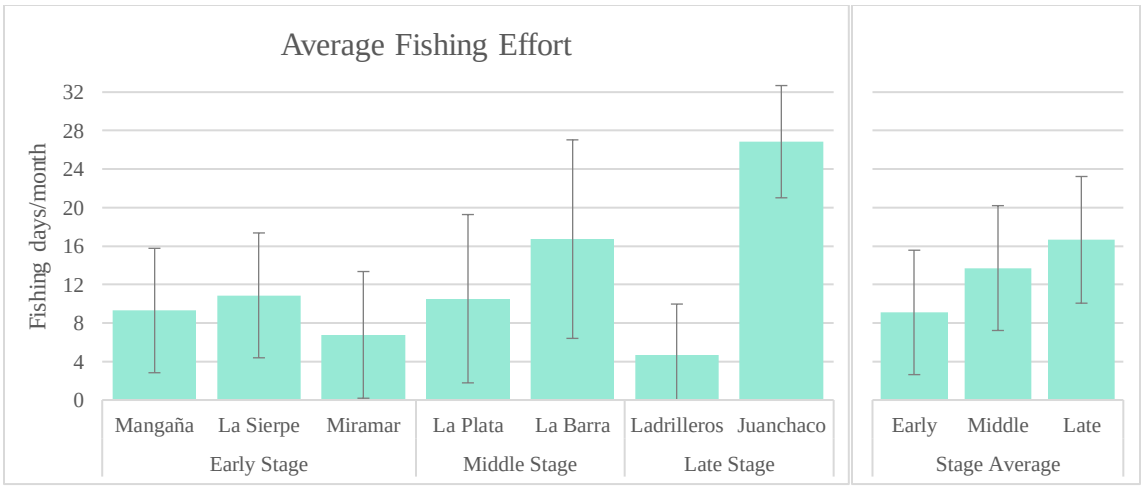

Figure 6: Average fishing effort among fishing households. Error bars represent one standard deviation.

c. Fishing Power among Fishing Households

Fishing power affects the catch potential and fishing mortality associated with a day of fishing and, like average fishing effort, was higher among fishers in communities with more tourism development, revealing a pattern of intensification (Figure 7). Fishing power varied considerably between communities and corresponded to significant differences in reported average catch. Differences in catch rate are reflected in the catch coefficients, which range from 0.6 to 3.5 (see Appendix D), and the highest power category had an average catch rate more than five times higher than the lowest power category.

Mangaña had the least tourism development and the lowest fishing power; all fishing households used a vessel but only 20% had access to a motor. Communities with more tourism development had incrementally higher fishing power, due mostly to greater access to motors, which increased to 44% of fishing households in La Sierpe, 69% in Miramar, and 88% in La Plata. On the other end, Juanchaco had the most developed tourism and also the highest overall fishing power; 80% of fishing households were in the highest power category and all used a boat and motor. Fishing power was lower in La Barra and Ladrilleros than

Miramar and La Plata despite higher levels of tourism development due largely to lower reliance on private boats and motors for transportation than in the bayside communities. Additionally, as described above, the beach erosion in Ladrilleros reduced local boat storage and contributed to the 13% of fishing households that had no vessel or motor.

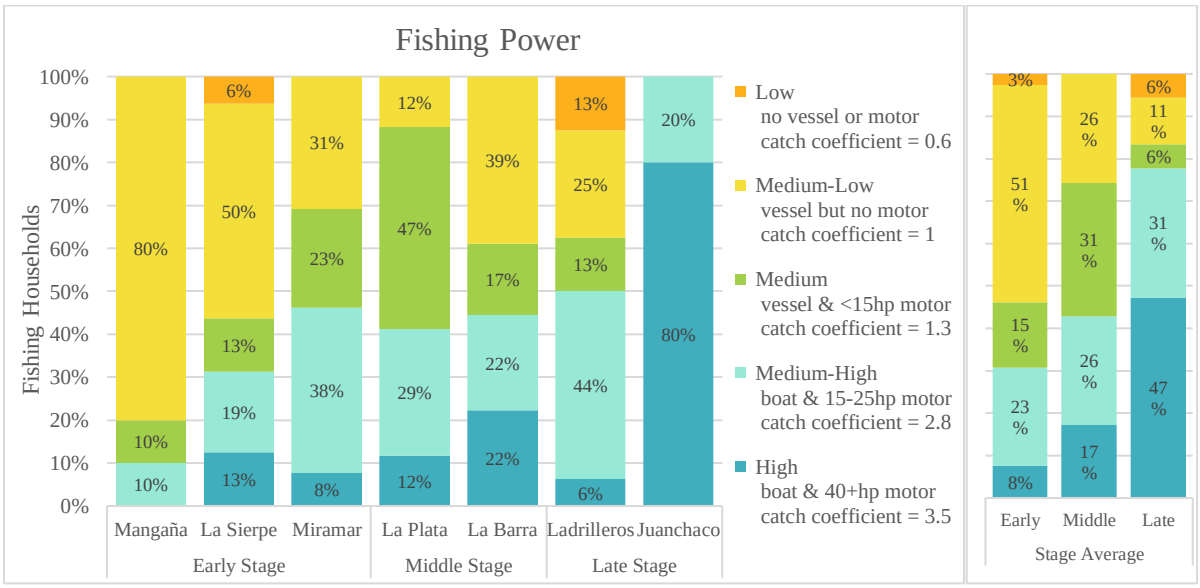

Figure 7: Distribution of fishing households by fishing power category.

2. Tourism Impacts on Fishing Pressure

The net effect of fishery participation, fishing effort, and fishing power combine to reveal a general pattern of higher fishing pressure in communities with more tourism development (Figure 8). Average household fishing pressure within the fishery (*only* fishing households) was three times higher in the late stage than the early stage, and eight times higher among fishing households in Juanchaco than in Mangaña. However, fishery participation also affects the *net* effect of tourism-related changes on fishing pressure and when calculated for *all* surveyed households, reveals a similar pattern though the magnitude of difference is less pronounced. In the early stage, community-wide per capita fishing pressure was 11.1 adjusted household fishing-days per month. This more than doubled in the middle stage to

25.1, and in Juanchaco, the community-wide average was three times higher than the in the early stage, at 33.5 adjusted household fishing-days per month. Ladrilleros was again the exception, as expected from the lowest reported participation and effort in the region, while the community-wide per capita fishing pressure in La Barra was nearly as high as in Juanchaco due to the combination of high participation and effort.

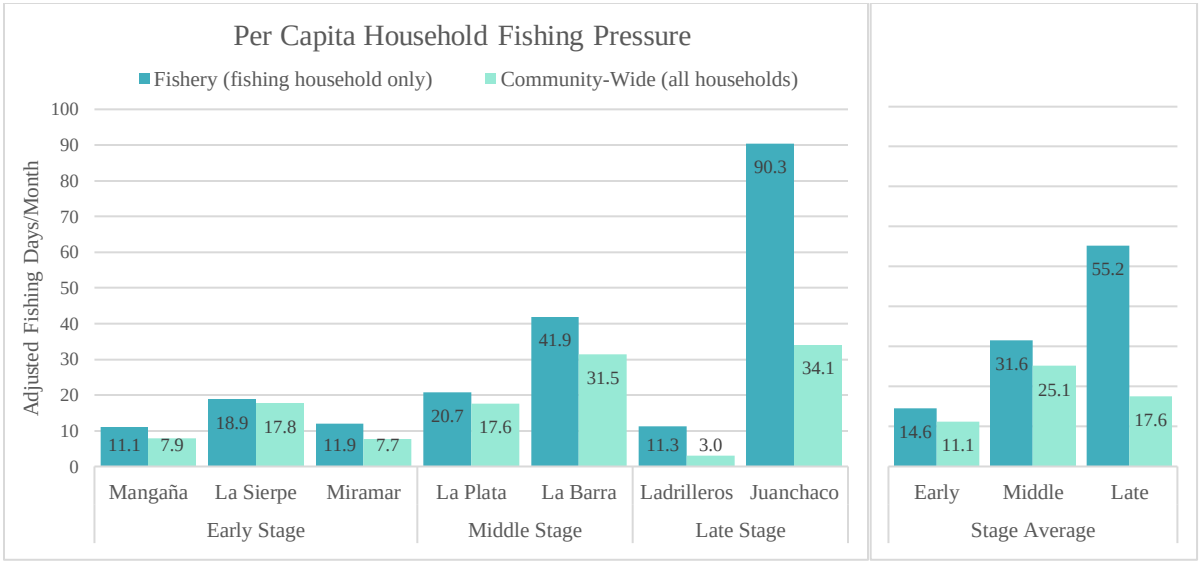

Figure 8: Average per capita fishing pressure within the fishery (*only* fishing households) and community-wide (*all* households).

The results suggest a nuanced effect of tourism development on overall fishing pressure, depending on the relative decline in participation and increase in effort and power. In Bahía Málaga, lower fishery participation was offset by higher average fishing effort since the difference in effort was roughly proportional to the difference in participation. If only participation and effort were used to calculate community-wide per capita fishing pressure, there would be variation between communities but no distinct difference between the three stages. However, adjusting for fishing power shows how improvements in fishing methods can have as big or bigger impact on fishing pressure than increases in fishing effort. Together this underscores the importance of including fishery participation, fishing effort, *and* fishing

power when estimating changes in fishing pressure, and suggests that though outcomes can vary, tourism development is likely to lead to higher fishing pressure.

3. Tourism Impacts on Household Livelihood Strategies

Data on fishing behavior from the seven communities in Bahía Málaga indicate that tourism development reshapes the fishery through the interaction of two opposing forces: a decrease in fishery participation and increase in fishing effort and fishing power among those who continue to fish. Both trends are consistent with a tourism-driven shift from diversified to increasingly specialized household livelihood strategies, changing the fishery from one of many part-time fishers to one of few full-time fishers.

a. Specialization in Livelihood Strategies

Across the seven communities, tourism development was associated with an increase in diversification of livelihood strategies and then a shift to specialization. In the early-stage, most households participated in a variety of natural resource-based livelihoods and nearly half of working individuals participated in at least three livelihoods. Diversified livelihood strategies prevailed in the middle-stage as tourism development added to the range of available livelihoods. Household participation was high in both natural resource-based and tourism sector livelihoods (see Figure 5) and the majority of individuals still participated in more than one livelihood. However, specialization became more common in the late-stage and 52% of individuals reported only one livelihood (Figure 9).

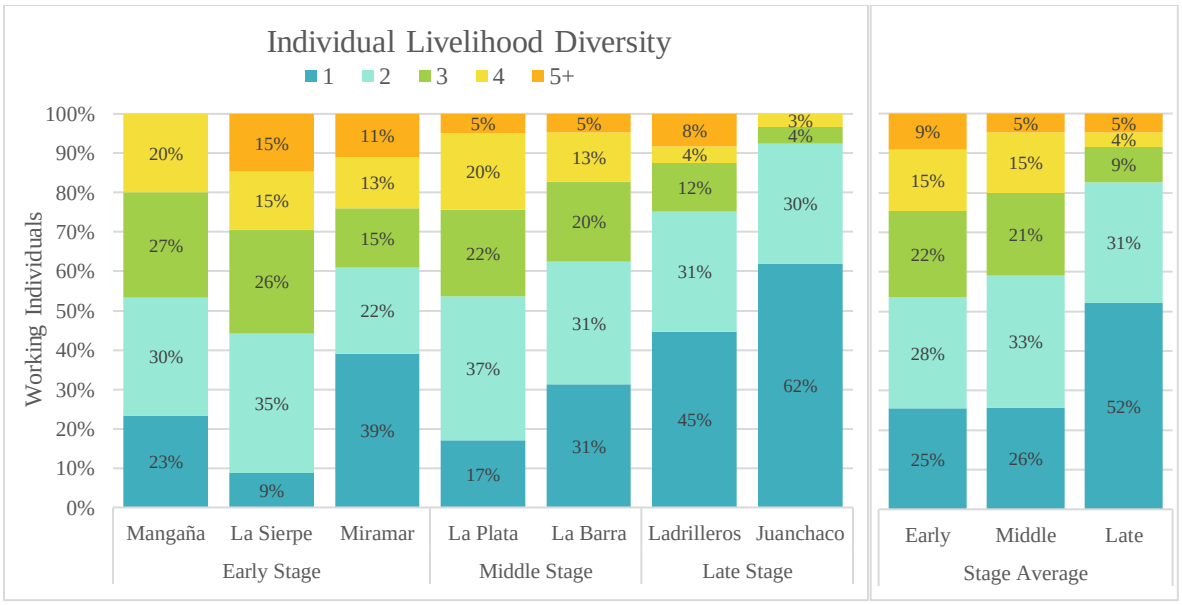

Figure 9: Livelihood diversity of working individuals based on number of reported livelihoods (see Table 2 for total reported livelihoods in each community).

b. Specialization in Fishing Behavior

The shift toward specialized livelihood strategies shaped fishing behavior in Bahía Málaga and can be seen in the distinct distribution pattern of household-level fishing effort in communities at each stage of tourism development (Figure 10). Fishing households in early-stage communities reported diverse effort levels ranging from 2 to 20 days/month. In the middle-stage communities, fishing households also reported diverse effort levels, but some reported up to the maximum of 30 days/month, indicating the emergence of full-time, specialized fishing. In the late-stage communities, most households did not fish at all (0 days/month), and most of those that fished either did so occasionally or full-time, with few households in between. In Juanchaco, 80% of fishing households reported fishing full-time, indicating widespread specialization within the local fishery. However, in Ladrilleros, where the majority of households had exited the fishery, 79% of those that continued to fish reported low effort levels.

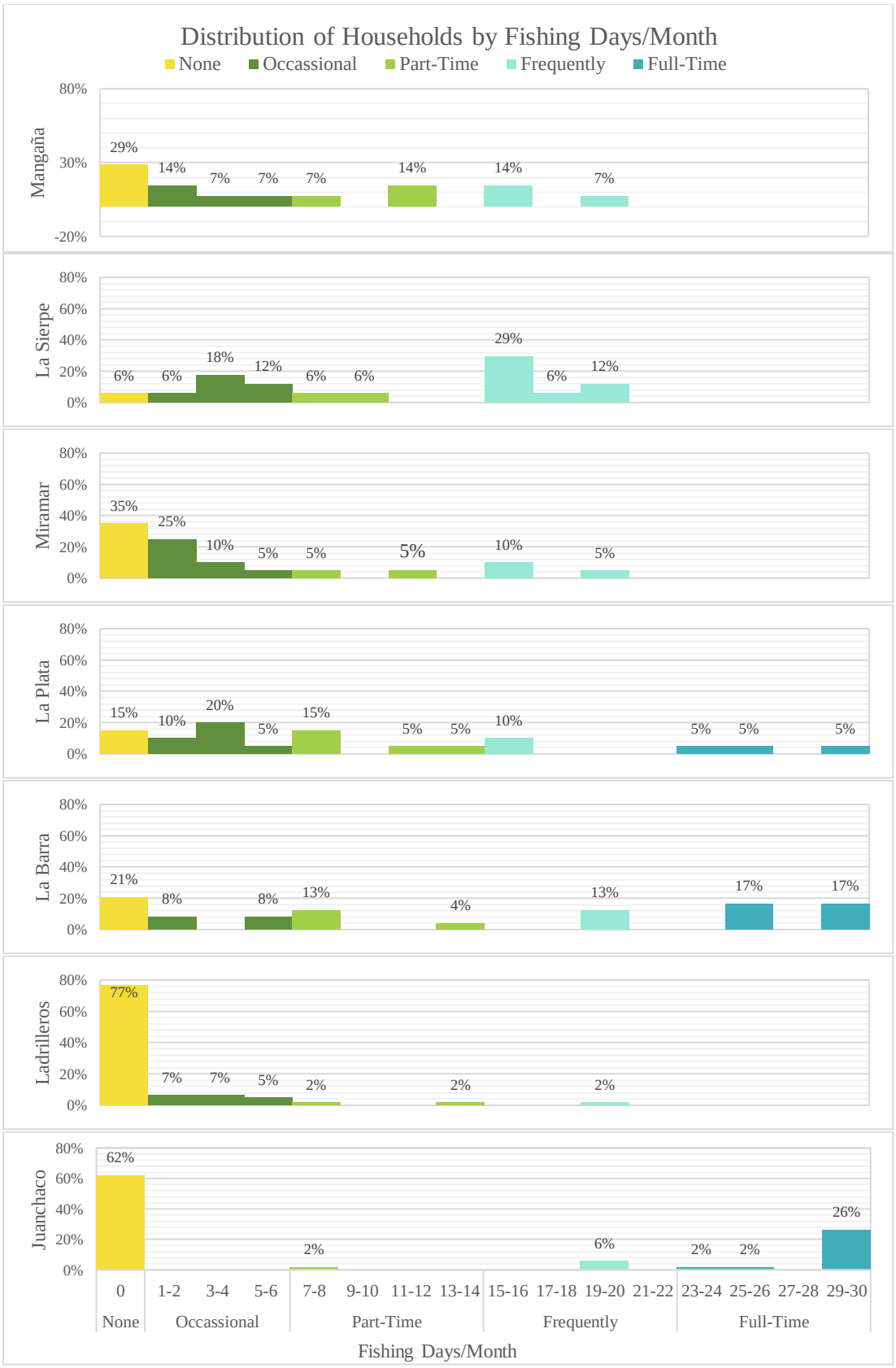
Distribution of Households by Fishing Days/Month
None
Occassional
Part-Time
Frequently
Full-Time
Mangaña
La Sierpe
Miramar
La Plata
La Barra
Ladrilleros
Juanchaco
0
1-2
3-4
5-6
7-8
9-10
11-12
13-14
15-16
17-18
19-20
21-22
23-24
25-26
27-28
29-30
None
Occassional
Part-Time
Frequently
Full-Time
Fishing Days/Month

Figure 10: Distribution of surveyed households according to fishing effort in each community in Bahía Málaga. Yellow bars represent non-fishing households.

c. Importance of Fishing as a Livelihood

The reported importance of fishing as a livelihood reflects the changing role of the fishery within the community as specialization replaced diversification (Figure 11). In the early-stage, fishing was widely practiced alongside other livelihoods and less than 20% of fishing households identified it as the most important, with over a quarter not listing in their top three. In the middle-stage, fishing was still widely practiced alongside other livelihoods, including in the tourism sector, but a greater percentage of fishing households identified it as their most important livelihood, likely due to emerging specialization among some fishing households. In both late-stage communities, participation in the fishery was low, but opposite levels of reported importance support other findings that fishing households in Juanchaco were highly specialized, but that in Ladrilleros, specialization in non-fishing livelihoods was common, even among households that continued to fish.

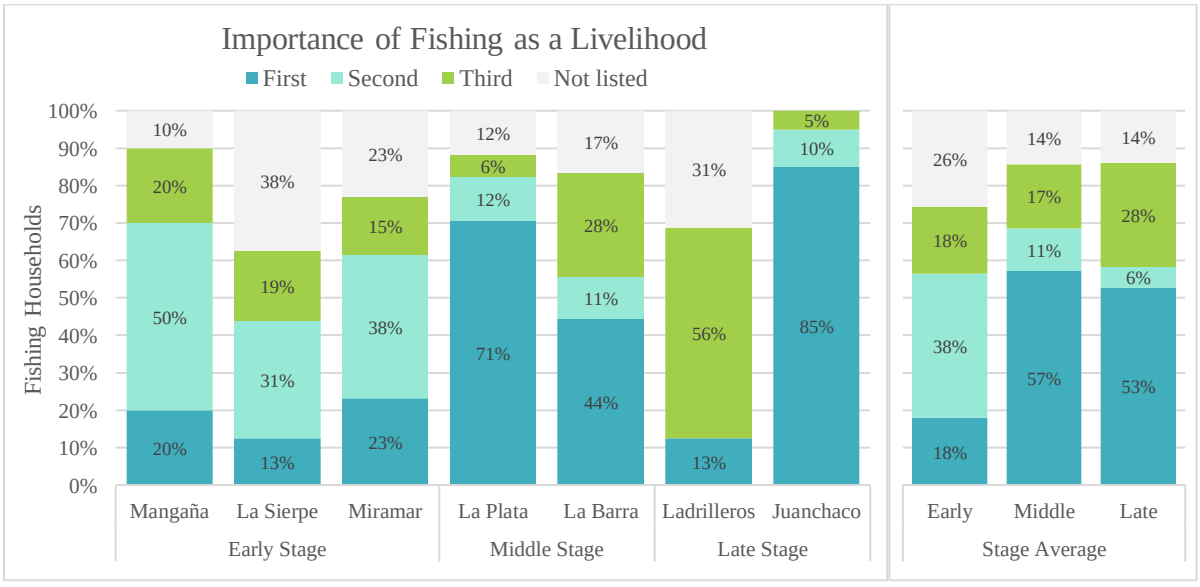

Figure 11: Ranking of the importance of fishing relative to other livelihoods among households that reported fishing in each community and within each stage.

D. Discussion

Tourism development impacts fishing behavior and reshapes the fishery, largely through expanding livelihood opportunities that lead to changes in participation and engagement. Livelihood decisions are made according to household needs, personal preferences, and cultural traditions, and will reflect the range and characteristics of livelihood options that are available in the community, keeping in mind that access is not uniform among community members. Fishery outcomes are related to how opportunities *within* the fishery compare to opportunities *outside* of the fishery, and while it is widely recognized that tourism development expands non-fishing livelihoods, the ways it can also increase opportunities within the fishery are less noted but equally important.

The next two sections present an integrated view of the interactions between tourism development and small-scale fisheries. First, describing the generalizable patterns and processes of tourism-related impacts on the fishery at each stage of tourism development (D.1) and exploring how community-level factors shape these interactions and explain the range of fishery outcomes observed in the literature (D.2).

1. Variation in tourism impacts across development stages

In the early stage, when tourism amenities are limited and visitors are few and infrequent, tourism will have little effect on current livelihood opportunities, but the anticipation of future tourism growth shapes households' decisions about livelihood investments. In Mangaña, for example, although no one worked in tourism, many expressed interest in doing so or described plans to build guest rooms or dining areas to accommodate tourists in the future. Proximity to communities with more established tourism development can also

expand tourism-related opportunities and create possible spill-over effects. For example, fishers from the early-stage communities sometimes sold catches to the tourist restaurant in La Plata.

The most significant changes occur during the middle stage, when the number of visitors and tourism amenities increase rapidly, leading to a significant expansion of livelihood opportunities. Initially this leads to further diversification as households adopt new livelihoods alongside their traditional livelihoods. Additional income earned from these opportunities can then be reinvested, either to intensify existing livelihoods, take advantage of new livelihoods, or both. For example, investing in better boats and motors expands a households' opportunities in tourism and facilitates intensification of fishing and other natural resource-based livelihoods. However, as development continues through the middle stage, related livelihood opportunities become more abundant and reliable, reducing the need to maintain diversified livelihoods. Competition among households for these opportunities and the desire to maximize profits make it more advantageous for households to invest their time and resources into fewer livelihoods, leading to a positive feedback loop of specialization and intensification. For example, specialized fishers are more likely to invest in better gear and fishers with better gear are in a better position to specialize in the fishery.

The middle stage is thus critical in shaping fisheries outcomes even though livelihood shifts are in flux and the impact of these changes on community-wide fishing pressure are not yet apparent. Before specialization, households can shift their effort and investment among diversified livelihoods fairly easily. However, once households begin to specialize, competition and their accumulated investments make it much more difficult and costly, and therefore unlikely, to adjust their livelihood engagement. The number of households that

specialize in the fishery or reduce fishing for other livelihoods is largely determined by the difference in access and opportunity in fishing versus non-fishing livelihoods. Accordingly, during this stage of development, although the mechanism is the same, the pattern of tourism impacts can begin to diverge at the community level.

In the late stage, when tourism is well established and annual visitors exceed the local population, the livelihood changes initiated during the middle stage become more apparent and impacts on the fishery more pronounced. Households are able to focus on improving or maintaining their capacity and competitiveness in increasingly specialized livelihoods. Most households that had begun shifting to non-fishing livelihoods leave the fishery all together, contributing to a significant drop in participation. At the same time, fishers continue to invest in better equipment and/or expand their operations, enabling an increase in their fishing pressure. For example, in Juanchaco, some fishing households invested in large freezers and additional fishing equipment that they rented or loaned in exchange for a share of the catches, which together facilitated increased fishing effort, greater accumulation of catches, and export of these catches to distal markets. However, the resulting impact on community-wide fishing pressure may differ considerably between communities depending on how many fishers specialize versus leave the fishery. In communities like Ladrilleros, where specialization primarily occurred in non-fishing livelihoods, few young people joined the fishery and most fishers further reduced effort and simplified their gear, resulting in lower individual and community-wide fishing pressure and the long-term contraction of the fishery.

2. Community-level variation in fishing pressure outcomes

The mechanism described above, of tourism impacts on fisheries through livelihood shifts, will be present wherever tourism is contributing to a broader development transition.

However, as Ladrilleros and Juanchaco demonstrate, the resulting outcome on fishing behavior and community-wide fishing pressure can differ considerably between communities. Differences in the rate of specialization in the fishery versus other livelihoods explains *how* this variation occurs, but it does not explain *why.* To address this question, this section shifts the analytical focus to the community-level, examining differences between communities *within* stages to better understand how biophysical and sociopolitical contextual factors shape tourism development outcomes within the fishery. In Bahía Málaga, the late-stage communities had a similar history and level of tourism development but very different levels of community-wide fishing pressure, while the middle-stage communities experienced distinct types of tourism development but with parallel effects on their fisheries. Examining the cause of these differences between communities in each stages provides an example of how, by altering the landscape of livelihood opportunities and shaping the process of livelihood specialization, contextual factors shape tourism impacts on the fishery.

Despite geographic proximity and similar histories of fishing and tourism development in Ladrilleros and Juanchaco, distinct environmental contexts contributed to dramatically different community-wide fishing pressure. In both communities, tourism development increased non-fishing livelihood opportunities and led to an overall decline in fishery participation. However, in Juanchaco, some fishers specialized and intensified, while in Ladrilleros, even fewer households continued fishing and most of them did so only occasionally. This difference was primarily due to limited access to the fishery in Ladrilleros, caused by coastal erosion following the 1997-1998 El Niño (see Correa and Gonzales, 2000; Morton *et al.*, 2000) that forced the community to relocate from the beach to the adjacent coastal bluffs. Since fishers traditionally stored their boats on the beach, this significantly

reduced opportunity in the fishery. However, the rapid decline in effort and departure from the fishery that followed was only possible because it coincided with significant tourism development that expanded non-fishing livelihood opportunities. Had the erosion occurred without tourism, most fishers would have adapted and continued fishing due to lack of alternatives, and had tourism development occurred without the erosion, the fishery in Ladrilleros would likely resemble Juanchaco. Although not related to climate change, this example offers insight into likely implications of climate change that is increasing the frequency and intensity of coastal hazards.

In the two middle-stage tourism communities, La Plata and La Barra, differences in the management of tourism development influence access to livelihood opportunities and the process of livelihood specialization. In La Plata, tourism is managed by a community-owned cooperative, and all tourism-related livelihood opportunities are distributed among community members within designated committees (accommodations, food, guiding services, etc.). This division of labor prevents competition and contributes to de facto specialization *within* the tourism sector. At the same time, ensuring wide distribution of tourism opportunities and economic benefits limits individual households' ability to specialize in *only* tourism, which helps maintain diversification and continuation of fishing and other traditional livelihoods. Moreover, although supplemental income invested into boats and motors facilitated higher fishing power, equal access to tourism-related opportunities and the anticipation of continued growth led to a smaller proportion of households specializing in the fishery. In contrast, tourism development in La Barra was not managed at the community level. Competition among households led to greater specialization across both tourism and fisheries livelihoods, and despite lower participation

and fishing power, resulted in higher fishing effort and community-wide fishing pressure than La Plata.

E. Conclusion

As tourism development expands in rural coastal regions and is looked to as an avenue to reduce dependence and pressure on small-scale fisheries, more information is needed about how tourism impacts fishing pressure. This research draws on a comparative case study to examine fishing behavior in communities at different stages of tourism development in order to estimate changes in fishing pressure over time. Findings support and connect a range of tourism impacts documented in the literature, including declining participation as households diversify their livelihoods and shift towards opportunities outside of the fishery, increasing fishing effort among those who stay in the fishery in response to new market opportunities, and intensification of fishing methods as fishers become increasingly specialized. Evaluating these impacts together reveals that an increase in fishing pressure is likely, however specific outcomes will differ depending on site-specific factors, even in neighboring communities that are otherwise very similar. This underscores the necessity of considering all three dimensions together, studying fisheries within the broader community context, and highlights the importance of locally informed tourism planning and fisheries management.

As tourism development reshapes the fishery from one of many, part-time fishers to one of fewer full-time fishers, it creates both opportunities and challenges for the long-term sustainability and management of the fishery. This research can help managers anticipate tourism-related impacts, inform proactive, adaptive fisheries management, and identify opportunities to leverage these changes to maximize benefits for the fishery (e.g., working with restaurants developing and markets for sustainable seafood or providing job training for

fishers looking to leave or diversify). Knowledge of common pathways of impact and likely outcomes can be used at larger scale to inform coastal development and, but planning and specific management approaches will be most successful at the local level where contextual differences that will shape outcomes can be taken into account. For example, factors related to the livelihood landscape (availability and accessibility of new livelihoods and access to marine resources and fishery markets) as well as factors that shape this landscape at the local level (environmental change, legal and customary land and resource rights, and the presence and strengths of local leadership and cooperation) – all of which will affect access, distribution of benefits, and outcomes for the fishery.

Tourism planning and regulation is most useful before and during the early stage and the middle stage is the most critical for community-wide or sector-specific interventions to shape the household livelihood decisions. For example, early on the community in La Plata made conscious choices about how what kind of tourism they wanted and ongoing management efforts continued to shape impacts through intentional distribution of livelihood opportunities. By the late stage, there is limited opportunity to shape tourism development or the nature of its impacts on local livelihood changes, but targeted management can mitigate emergent challenges in the fishery, such as those related to new gear types or increased pressure on certain species. Additionally, tourism-related changes in the fishery present new opportunities, for example a smaller and more professional fishery may lead to higher fishing pressure and erode traditional harvest controls and management practices, but it is also better suited for conventional management strategies that may be cooperatively agreed on or implemented in coordination in with centralized management agencies.

Comparison of these communities suggests that local tourism planning and resource management are more likely to be successful when there is strong local leadership, established land and resource rights, and a history of cooperative decisions making, and that prior knowledge or experience of tourism is also beneficial. These factors influence livelihood transitions and the distribution of benefits and have been broadly recognized for their importance in governance of common pool resources (Ostrom, 2009; Gutiérrez, Hilborn and Defeo, 2011; Su, Wall and Jin, 2016). Findings also align with others that have written more extensively about factors that are likely to promote sustainable tourism development in rural areas and there is opportunity for more intentional integration of this research into integrated tourism planning and fisheries management (e.g., Castellani and Sala, 2010; Bennett *et al.*, 2012; Agyeiwaah, Mckercher and Suntikul, 2017; Scheyvens and Biddulph, 2018).

These findings are widely applicable to rural tourism development scenarios, especially given the emphasis on locally informed management to assess, anticipate, and plan for likely impacts. However, given the diversity of development scenarios and coastal fisheries, more research that examines these questions over time and in different community contexts will further expand our capacity to understand and anticipate tourism impacts on the fishery and facilitate data-driven planning and management of tourism and fisheries in the future. In particular, research is needed on how tourism development and fishery impacts are shaped by socio-political and environmental factors and how they are connected in time and space. Additionally, this analysis has focused on tourism impacts on fishing pressure, which is related to the ecological sustainability of fisheries, but more research is also needed on the socio-economic and cultural dynamics of the fishery, both to explore how these dimensions

shape fishery outcomes and to understand the social implications of tourism-related changes in small-scale fisheries.

Finally, unlike land-based resources, fishery resources are mobile, explicit ownership is uncommon, and access to the fishery is shaped by access to coastal land and/or port infrastructure and can be expanded with different equipment (larger boats and motors or specialized gear can access more distant resources), all of which are affected by tourism development. So while these findings contribute to and align with similar research on rural development transitions and sustainable livelihoods in other settings, they also raise additional questions about how changes in livelihood and resource-use in the fishery compare with tourism impacts on other natural resource-based livelihoods including land-based sectors like farming and logging, and other forms of marine resource use like coastal gleaning.

Chapter 4: Gleaning for Resilience versus Fishing for Profit – divergent livelihoods response to tourism development in small-scale marine resource-use

A. Introduction

Rural coastal regions are experiencing large-scale transformations due to growing coastal populations and development in the tourism, transportation, and energy sectors. This development is only expected to accelerate as governments, investors, and development agencies shift attention to "Blue Growth" of the "Blue Economy" (Bennett *et al.*, 2019; Cohen *et al.*, 2019; Schutter *et al.*, 2021). The resulting shifts in natural resource-based livelihoods have major socio-ecological implications, both for the sustainability of local resources systems and for the socio-economic resilience, wellbeing, food security of individuals and communities.

Fisheries and aquaculture are among the most important coastal livelihood strategies and are thus among the most affected by coastal development. Although industrial fisheries and aquaculture account for the majority of seafood production, the small-scale sector accounts for up to half of global wild seafood catches, employs 90% of fishers, and is disproportionately concentrated in rural developing coastal regions (FAO, 2015). Like many small-scale sectors, small scale fisheries (SSF) are especially important as a livelihood and source of food, both directly as subsistence as well as indirectly through local and regional trade. Harvesting practices in SSFs also have sustainability implications. Loss of traditional management practices, degraded ecosystems (from development, runoff, dredging, climate

change), and harvest pressure from commercial fishing fleets have led to declining catches in many areas and some SSFs are severely depleted.

This paper examines the effects of coastal tourism development on gleaning, a form of small-scale marine resource-use akin to ocean foraging or gathering. Within the context of already "data poor" small-scale fisheries (Kolding, Béné and Bavinck, 2014; Tilley *et al.*, 2018; Pita, Villasante and Pascual-Fernández, 2019), there are major gaps in data and understanding about the extent of gleaning activity, the importance of gleaned harvests in local households and markets, and the effects of coastal development on gleaning activity and harvest pressure. The gaps in knowledge reflect research biases in SSF towards boat-based fisheries, income-generating livelihoods, and bony fish species, resulting in the omission, exclusion, or undervaluation of gleaning. The gender dynamics of labor in fisheries also play a role in creating this gap. The majority of gleaning is done by women and the societal invisibility of women's labor, as well as the mistaken assumption that fishing is an exclusively male domain, lead women's fishing and marine resource use to be overlooked (Williams *et al.*, 2002; Chuenpagdee *et al.*, 2006).

My comparative case study of seven rural coastal communities in the Colombian Pacific analyzes the effects of tourism development on gleaning activity. The research finds that greater livelihood opportunities due to tourism development are associated with the decline in gleaning activities in the study communities. However, the dynamics of the decline in gleaning, in contrast to tourism-driven changes in other natural-resource-based livelihoods such as small-scale fishing, also showcase the extent to which rural development transitions are mediated by the socio-ecological characteristics of particular resource systems. Overall, the research provides insight into the different ways that development can affect natural

resource-based livelihoods and the implication of these changes on household and community wellbeing and resilience and on natural resource management.

1. Rural Development Transitions and Sustainable Livelihoods

The research draws on the Sustainable Livelihoods Approach and Framework (Chambers and Conway, 1992; Ellis, 1998; Scoones, 1998, 2009, 2015) to better understand and compare tourism impacts on coastal livelihoods. In this framework, livelihood decisions are understood to be dynamic and adaptive strategies that are shaped by household and individual livelihood needs, preferences, and opportunities, access to resources, and the broader socio-political landscape. Development transitions reshape livelihood strategies. Development enables intensification and extensification of production through modernization and greater connectivity and access to markets. Intensification and extensification in turn may drive increased rates of land cover land use change, soil depletion, and/or harvest pressure. However, expanded non-resource-based livelihoods may reduce dependence and pressure on local resources. Whether from increased production or newly available or expanded livelihoods outside of the natural resources sector, development is expected to increase economic status and improve local living standards through infrastructure and public services. However, it can also lead to displacement and marginalization of community and increased instability and vulnerability if they lose ability to provide for themselves from the land/forest/water. Change in population, social organization, and extent of state presence can also shift formal and informal land rights and governance regimes.

In rural coastal regions in the Global South, tourism is widespread and has been an important driver of coastal development and associated livelihood transitions (Marafa and Chau, 2014; Spalding *et al.*, 2017; Spalding and Parrett, 2019). Tourists are attracted to (the

idea of) the natural landscapes and empty beaches of less developed coastal areas. As tourism develops, transportation and infrastructure also expand, which facilitates the arrival of more people and other forms of development, helps integrate the region into the national economy, and increases access into peripheral areas (Sinclair, 1998). These reasons and the fact that tourism is a major source of foreign exchange make it an attractive development strategy for national governments, especially in the tropics and the Global South. Additionally, tourism has been promoted as a form of sustainable development (Markovic *et al.*, 2009), in part because it is not directly dependent on natural resource extraction, but also for its potential to reduce dependence on natural resources by providing economic alternatives and to incentivize or fund conservation management or protected areas (e.g., safari parks in Southern Africa or tourism-linked MPAs (Brunnschweiler, 2010)).

2. Marine Resource-Based Livelihoods in Coastal Communities

Small-scale fisheries have been a growing area of research over the past decade but remain a somewhat problematic category due to varying definitions, both in terms of what is considered "fishing" and what counts as "small-scale." In the narrowest sense fishing refers to boat-based harvest of bony fish species using a range of gear types, such as nets, long lines, or hook-and-line equipment. However, it is also frequently used more broadly to refer to the harvest of any plants or animals found in the water. This broader definition therefore would also include algae and many invertebrates and a wider array of harvest techniques and locations. Small-scale most often refers to harvests done with low-tech gear, by individual fishers, for subsistence and local trade (Teh and Sumaila, 2013; Kleiber, Harris and Vincent, 2015; Isaacs and Witbooi, 2019), but what is considered small and low-tech varies by region

and there is overlap with other categories such as artisanal, subsistence, and recreational fishing.

Thus, the broadest definition of SSF encompasses a vast swath of marine resource harvest and livelihoods, ranging from subsistence gleaning of seaweed to small-scale commercial catches of high-value bony fishes. However, this full range is often not included in research, or is only partially represented. For example, research that identifies fishers as those using boats in a port may fail to include other categories of small-scale users, or may document other uses, such as pier fishing or gleaning, if and when reported by boat-based fishers. Nevertheless, that fishing activity will not be sufficiently represented in the sample. In this paper, fishing is used to refer to boat-based harvest of bony fishes using some sort of in-water gear[8], while gleaning refers to manual shore-based harvest of invertebrates, and marine resource use encompasses both.

The focus of this research is on gleaning, which involves the manual harvest of invertebrate species (e.g., shellfish, sea cucumber, urchin, octopus, crabs) from near-shore habitats (coral reefs, seagrass beds, mangroves, mud flats, tide pools). In areas where the practice is widespread it can represent a large share of total seafood harvests (e.g. Papua New Guinea, Samoa, Micronesia, be an important part of local diets, in some cases generate significant income (e.g. sea cucumber or bêche-de-mer), and often has social, recreational, and cultural significance (Williams *et al.*, 2002; Waycott *et al.*, 2011; Harper *et al.*, 2013; Mills *et al.*, 2017; Bell *et al.*, 2018; Furkon and Ambo-Rappe, 2019; Grantham, Lau and Kleiber, 2020; Tilley *et al.*, 2021). Compared to fishing, gleaning is labor intensive and often

[8] Exceptions include spearfishing or boat-based invertebrate fisheries that use nets (squid, shrimp) or traps (lobster, crabs).

viewed as lower status due to the manual, muddy, labor, and low profit margins (see Falanruw 1992 in Williams *et al.*, 2002; Malm, 2009; Ogden, 2017). Gleaning is primarily practiced by women and children, due to both practical and cultural reasons. Including that it can be done close to home and in the company of children, takes relatively little time and requires no specialized gear or heavy equipment, contributes to household diets and income, but does not bear the same safety risks or physical demands of fishing (Williams *et al.*, 2002; Choo, Hall and Williams, 2006; Chuenpagdee *et al.*, 2006; Ogden, 2017; Ferguson, 2021). This is especially true in cultures or communities where women are assigned the primary responsibilities of the household and childcare and so are spatially constrained, and in some cases, the gendered division of labor is reinforced by cultural taboos that discourage or prohibit women from engaging in boat-based fishing (Williams *et al.*, 2002).

The limited literature on tourism impacts on and interactions with small-scale fisheries was synthesized in Chapter 1. Research on the effects of tourism development on gleaning is even more limited. In Zanzibar, the tourism-related curio trade put pressure on nearshore habitats and species which could affect gleaning indirectly or create a new market for gleaning harvests though this was not specified (Gossling *et al.*, 2004). Tourism development has also been found to limit gleaners' ability to access nearshore resources through coastal privatization and sometimes linked with coastal conservation enclosures (Segi, 2014).

B. Background and Research Methods

The effects of tourism development on gleaning and how they contrast with small-scale fishing are examined through a comparative case study of marine resource use and livelihoods in seven neighboring communities around Bahía Málaga in the Colombian Pacific. Fishing and gleaning have been a primary source of food and income in these

communities and more recently tourism development has become the most important economic sector. However, tourism development has occurred at different rates, offering a snapshot of livelihoods and marine resource-use at different stages in the tourism development process.

1. Study Context

The seven study communities are located in and around Bahía Málaga on the Pacific Coast of Colombia. The area is only accessible by boat from the port of Buenaventura, approximately 24 miles to the south, and like much of the pacific region, infrastructure is underdeveloped and access to basic amenities is limited (Arboleda Home, 1993; Cantera Kintz *et al.*, 2013). The population is primarily Afro-Colombian, living in small coastal communities that share similar socio-cultural traditions and resource-use practices.[9] Three communities, Juanchaco, Ladrilleros, and La Barra, are situated near the mouth of the bay facing the ocean (beachfront) and can be reached by daily ferries between Juanchaco and Buenaventura. The other four communities, La Plata, Miramar, La Sierpe, and Mangaña, are located in the interior of the bay (bayside) and are only accessible by private boat (Figure 12). In 2010 the bay and surrounding ocean were declared a National Park to protect the exceptional biodiversity and humpback whales that come to calve and breed in the bay (INVEMAR, UNIVALLE and INCIVA, 2006; Florez-Gonzalez *et al.*, 2007; Ministerio de Ambiente Vivienda y Desarrollo Territorial, 2010; Cantera Kintz *et al.*, 2013).[10]

[9] Surveys were collected in an eighth community but excluded from analysis due to insufficient data.

[10] Parque Natural Nacional Uramba Bahía Málaga protects 47,094 marine hectares of the ocean, bay, islands, and coastline, and represents 25.88% of the Buenaventura Ecoregion.

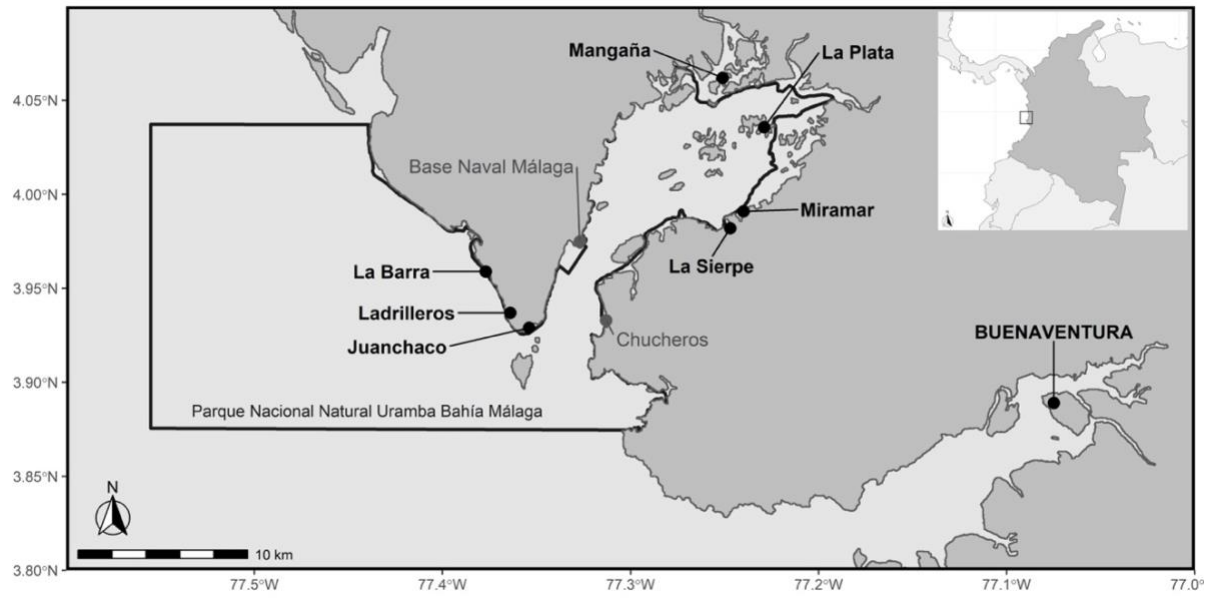

Figure 12: Map of study region and communities in Bahía Málaga, Valle del Cauca, Colombia

These communities have traditionally depended on natural resource-based livelihoods, especially fishing and gleaning, as well as farming, logging, and hunting. Fishing primarily targets finfish, including nearshore estuarine species and open ocean pelagic species, as well as sharks, rays, and shrimp and catches are consumed at home or sold locally. It is done alone or in small groups from canoes or open-deck boats with small outboard motors. Hand lines, long lines, and various nets are used (Appendix B) (Caicedo Pantoja, Zapata Padilla and Roldán Ortiz, 2008; Chaves Lozada, 2014; Tilley and Box, 2014). Gleaning is primarily done in the mangrove forests and although other species of mollusks and crustaceans are sometimes gathered, the vast majority of harvest comes from two species of mangrove cockle *(Anadara similis & Anadara tuberculosa),* locally called piangua.

More recently tourism has become the major economic sector in the region. Tourism in Bahía Málaga is small-scale and largely unregulated. Tourism development accelerated following the construction of a pier in Juanchaco and the beginning of ferry services in 1992. Whale watching began in 1994 and is the most important attraction alongside beaches,

waterfalls, and nature tours. Approximately 12,000 tourists visit the region annually, the majority coming from within Colombia during the whale watching season (July-Oct) and around Christmas, New Year, and Easter holidays (Avila, Correa and Parsons, 2015). Tourism amenities include family- or community-owned restaurants and guest houses and small to mid-size hotels that are mostly owned by Colombians from cities in the interior of the country. Tours, transportation, and other services are provided by locals and, aside from limited employment in the public sector, the majority of livelihoods are informal.

Development has been uneven and largely reflects differences in accessibility, with most tourism concentrated in the beachfront communities (Juanchaco, Ladrilleros, and La Barra) that can be reached daily by ferries from Buenaventura and less in the bayside communities (La Plata, Miramar, La Sierpe, and Mangaña) that are only accessible by private boat (Table 1). Accessibility (i.e. difficulty, time, and expense) is a critical determinant of the timing and extent of tourism development (Khadaroo and Seetanah, 2007), which is a continuous process but passes through identifiable stages, simplified here into early, middle and late (from the five stages originally described by Butler [1980], see Appendix A). The seven communities can be categorized into distinct tourism development stages according to their history and characteristics of tourism development at the time of research (Figure 4, Table 1) (Zuluaga Garcia, 2014). Mangaña, La Sierpe, and Miramar were in the early stage of tourism development, La Plata and La Barra in the middle stage, and Ladrilleros and Juanchaco in the late stage.

Mangaña had the least developed infrastructure and effectively no tourism, while La Sierpe and Miramar had basic facilities, but visitors were infrequent. La Plata and La Barra were both in a period of tourism growth. Tourism was younger and faster-growing in La

Plata where a community-owned, cooperatively managed eco- and ethno-tourism company was started in 2008 and operated two guest houses, a restaurant kiosk, and various ecological and cultural tours and activities (Lobo, Velez and Puerto, 2016). Tourism began in La Barra earlier than La Plata due to its proximity and accessibility from Ladrilleros and Juanchaco, but unlike those communities, amenities were only provided by local families and included camping shelters and rented rooms, beachside restaurant kiosks, and informal guided tours. Ladrilleros and Juanchaco received the most tourists and had the most extensive and developed infrastructure and amenities, including hotels, restaurants, bars, and stores. Ladrilleros had the greatest extent and diversity of tourism amenities, with accommodations ranging from small hostels to higher-end mid-size hotels. Juanchaco had fewer hotels than Ladrilleros but was the primary departure point for whale watching tours and, as the central transit hub and largest community, had more public services (health, education, police, banking) and infrastructure than other communities.

2. Research Design, Data Collection and Analysis

The comparative case analysis uses the differences in the tourism development stage across the seven communities to approximate tourism development impacts over time. This approach is similar to the space-for-time substitution method used in the natural sciences (Pickett, 1989). Each stage (early, middle, late) was represented by multiple study communities, so differences across stages of tourism development were used to identify more generalizable patterns, and differences among communities within the same development stage provided additional analytical nuance and insights into when and how impacts occur. Research was conducted between 2015 and 2018 and included initial site visits, 14 months of ethnographic fieldwork, including interviews and household surveys, and follow-up site

visits. Data on individual and community-level livelihoods and resource-use were collected through surveys and ethnographic methods, enabling quantitative and qualitative comparative assessments of the processes of change and the factors that shape or influence outcomes or differences.

a. Data Collection

The in-depth household survey was designed to collect data about livelihood engagement and natural resource use, with additional questions about diet and food security, socio-economic status, subjective wellbeing, cooperation, and governance (survey available in Appendix C). Interviews were conducted with male and female community members of different ages to inform the design and language of the survey. The survey was reviewed by local leaders and piloted in the beachfront communities before data collection began. A research assistant from each community was trained to administer the survey and worked together with the author to collect a total of 208 surveys from across the seven communities between June and September 2016 (Table 2).

In order to select a random sample of households, field censuses were conducted in each community. The census was provided by local leaders in the bayside communities and produced through GPS field census in the larger beachside communities. A random number generator was used to assign all households a number between 0 and 1, and households were sampled from lowest to highest with the goal to survey at least 20% of the community, or at least 20 households in communities with less than 100 households). Households that declined to participate or were unavailable after multiple visits were replaced by the household with the next highest number on the list. All households were surveyed in the three smallest communities, but some were away from the community during the survey period. Survey

data was summarized and shared with individuals and leaders in each community during follow-up field visits in 2017-2018 to evaluate its accuracy and elicit additional feedback and clarification.

Within each household, survey respondents answered questions about the livelihood activity for each working individual. Natural resource-based livelihoods, including fishing, gleaning, logging, farming, and hunting, were disaggregated in data collection and additional questions were asked about effort and use of catch/harvest for each.[11] Tourism sector livelihoods include work in hospitality, dining, guiding, and entertainment. The informal sector includes aspects of sales, services, transportation, and construction. Public sector includes education, health, utility, and park workers.

Table 3: Household and Individual Surveys and Response Rates

	Community	Households		Percent Surveyed	Response Rate	Individual Livelihood Surveys	Total Reported Livelihoods
		Total	Surveyed				
Early Stage	Mangaña	16	14	88%	100%	23	9
	La Sierpe	19	17	89%	100%	35	12
	Miramar	23	20	87%	100%	46	16
Middle Stage	La Plata	44	20	45%	100%	41	18
	La Barra	68	24	35%	92%	64	19
Late Stage	Ladrilleros	180	60	33%	90%	121	27
	Juanchaco	250	53	21%	87%	95	20
Early Stage		58	51	88%	100%	104	18
Middle Stage		112	44	39%	95%	105	21
Late Stage		430	113	26%	89%	216	28

b. Data Analysis

In order to understand the relationship between tourism development and marine resource use, household survey data were used to evaluate household participation and effort in each

[11] At the individual-level, effort in natural resource sectors was not disaggregated.

livelihood sector as well as its relative importance in their household. Community-wide livelihood participation is the percent of surveyed households and individuals that reported engaging in each livelihood within the past 12 months. Individual livelihood data was collected for working members of each household, which usually included everyone except small children and the elderly. Demographically, individuals were considered adolescent if they were under 20 years old and lived with parents or older family members. Effort is the average number of days per month spent engaging in each livelihood activity. Households ranked their three most important livelihoods in terms of overall importance, economic contributions, and time spent. Livelihood diversity reflects the number of livelihoods reported by each working individual over the past 12 months.

Qualitative data from ethnographic field work was synthesized at the community-level to identify causal mechanisms (e.g. causal process observations (Dunning, 2012)) and site-specific factors that might have shaped these interactions and contributed to observed differences.

C. Gleaning in Bahía Málaga

Gleaning activity in Bahia Malaga focuses on piangua (*Anadara similis & Anadara tuberculosa*), a bivalve found in mangrove forests from Baja California to northern Peru (Delgado *et al.*, 2010), although of greatest density in the Colombian Pacific and northern Ecuador. It is also known as the mangrove cockle or arc clam, or Concha Negra, Concha Prieta, or Mansita in Latin America. *Anadara tuberculosa*, referred to as "Piangua Hembra", is more abundant and is the one sold to markets because its thicker shells are suitable to storing and transporting. *Anadara similis*, referred to as "Piangua Macho," is less abundant and is primarily consumed in home because its weaker shells cannot withstand transportation

to market (Puentes *et al.*, 2014). Harvests contribute to household diets and are sold or traded locally or to an intermediary in the community who facilities sales in Buenaventura (Puentes *et al.*, 2014). At the national level, 15-20% of piangua harvests stay in Colombia with the remainder exported to Ecuador (Otero Benavides, 2015). In Ecuador, the piangua population was decimated by over harvesting and mangrove destruction for shrimp farms. Due to its economic significance and role in local diets, it is one of the better studied invertebrate species in the region.

Piangua live in the mud around mangrove roots, between 5-30 cm deep. The seven study communities vary in their access to piangua habitat. Mangaña and La Plata are both located at sea level near each other towards the back of the bay, where they have similar access to extensive harvest areas (Aldana Ballen, 2014). La Sierpe and Miramar are both located on elevated bluffs very close to each other with less immediate access to mangroves than Mangaña and La Plata. Among the beachfront communities, La Barra has the most extensive access to harvest areas, but Ladrilleros has inland access to estuary harvest areas and Juanchaco can access harvest areas in the bay.

To harvest piangua, gleaners stand in water and use their hands or simple stick-tools to locate and extract the bivalve. Gleaning can be done alone or in small social groups, trips last 4-8 hours, and harvest areas are reached on foot or in canoe. Access depends on the tidal cycle, resulting in approximately 15 days a month that are suitable for gleaning (Puentes *et al.*, 2014; Otero Benavides, 2015). Once harvested, piangua are collected and can be kept alive in a permeable bag or a basket for up to two weeks when kept below the high tide line. Traditionally gleaning is done by women and adolescents, but market opportunities related to export to Ecuador has led to increased participation among men (Otero Benavides, 2015;

Barrero-Amórtegui and Maldonado, 2021). Harvest volume varies considerably between locations depending on exploitation rates and the health of the ecosystem. Studies of gleaning in Valle del Cauca have reported average daily harvests between 112 and 152 piangua per person (Delgado *et al.*, 2010; Otero Benavides, 2015) and the highest average daily harvest, 336 piangua per person, was reported in La Plata in Bahía Málaga (Tilley and Box, 2014).

Throughout Colombia the minimum harvest size is adequately set at 50 mm, which is above the minimum size of sexual maturity (Lucero-Rincón *et al.*, 2013; Puentes *et al.*, 2014). The community of La Plata-Bahía Málaga rotate harvest areas, agreed not to harvest during certain tidal periods each month, designated annual rest periods (*descansos*) in the harvest, and collaborate with scientists in monitoring and management of piangua (INVEMAR, UNIVALLE and INCIVA, 2006; Velez, 2009; Chaves Lozada, 2014). As a result, the resource is relatively healthy in Bahía Málaga compared to other areas in the department (around Buenaventura Bay and to the south) (Tilley and Box, 2014), but some studies have documented a decline in the piangua population related to environmental factors and overharvesting (Lucero, Cantera and Nelra, 2012). The strong 1997-1998 El Niño had a negative impact on piangua populations throughout the Pacific coast (Borda and Cruz, 2004), oil from chainsaws (logging) and boats has degraded mangrove habitats, and although illegal, some logging within the mangroves has further harmed harvest regions.

D. Results

1. Tourism Impacts on Gleaning Activity

a. Importance and Participation

Tourism development has had a significant effect on piangua gleaning in Bahía Málaga. Nearly half of all gleaning households in early-stage communities identified gleaning as their most important livelihood. In comparison, no gleaning households in the middle-stage communities identified it as the most important livelihood, despite no significant change in average effort. In La Plata the majority of households ranked it as second, but in La Barra two thirds did not even list it in the top three (Figure 13).[12] In the late-stage communities, where tourism was already well established, no gleaning was reported as a livelihood, and it was only occasionally observed as a form of play or recreation among children.

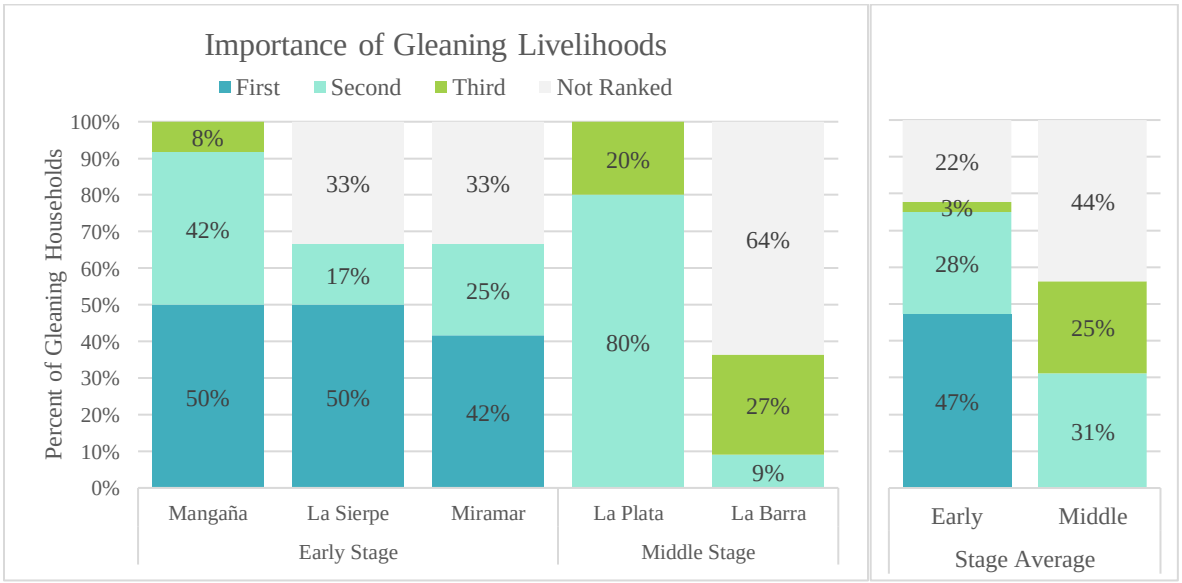

Figure 13: Overall importance of gleaning, ranked relative to other livelihoods, by households that reported gleaning.

[12] There was a similar pattern in importance when ranked in terms of income generation and time spent but gleaning ranked lower overall across all communities (see Appendix F).

Lower rates of household and individual participation in communities with more tourism development also suggest that tourism leads to a decline in the importance of gleaning at the community level. The highest participation was in the community with the least tourism development, where gleaning was reported by 80% of surveyed individuals and there was no participation in the tourism sector. The rate of gleaning participation was progressively lower across the spectrum of tourism development, with around half of individuals in La Sierpe and Miramar gleaning and less than a quarter in La Plata and La Barra. Household-level participation followed the same pattern, with the exception of La Barra, which had higher household participation than La Plata because individual gleaners were spread out among more households (fewer gleaners per household). Meanwhile, the rate of participation in tourism was progressively higher, from 0% in Mangaña, to less than 10% in La Sierpe and Miramar, 60% of households in La Plata, and 92% of households in La Barra. Individual participation rates in the tourism sector followed a similar pattern of increase but were lower than household participation rates, indicating that most households had only one person engaged in tourism (Figure 14).

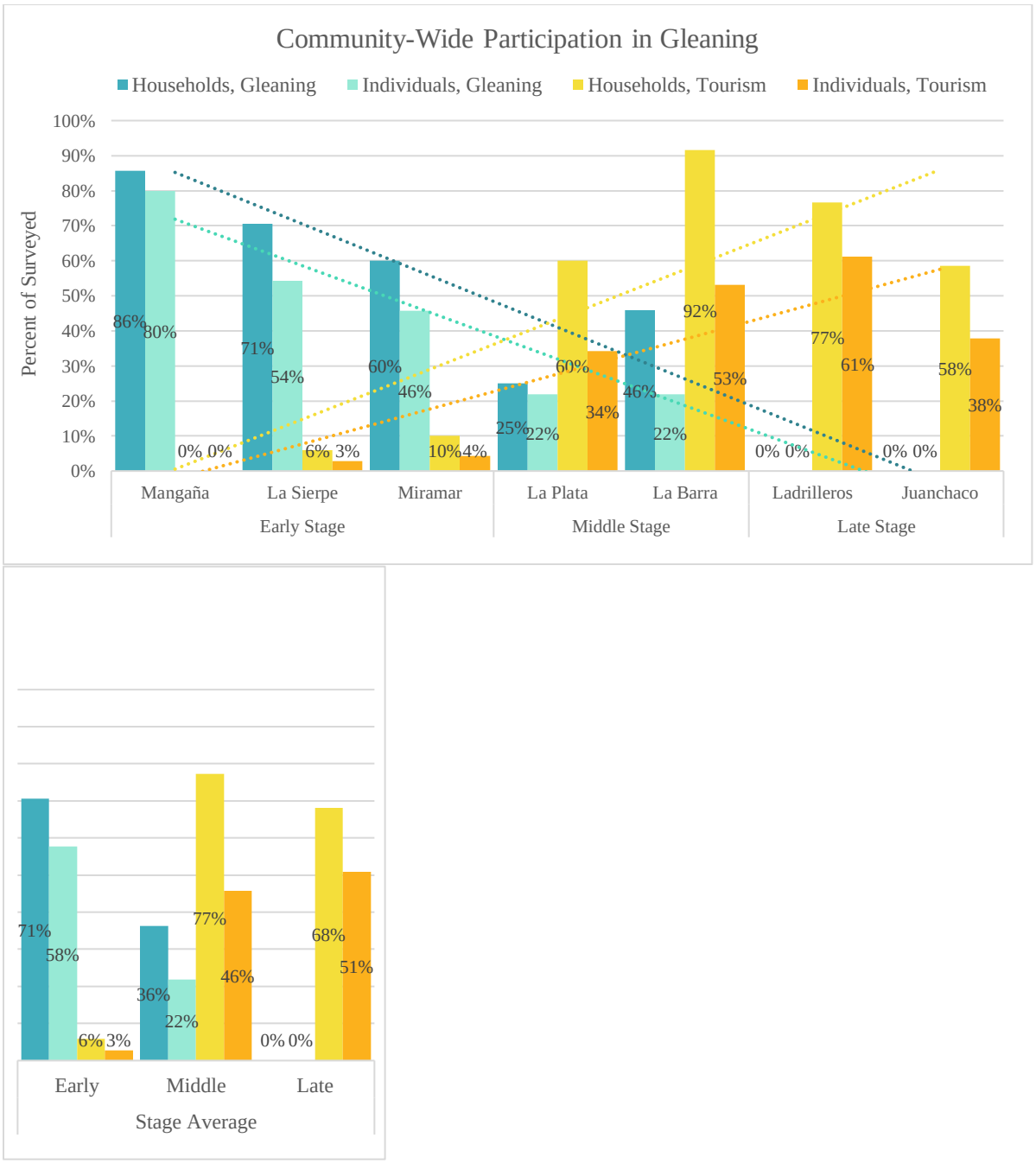

Figure 14: Individual and household-level participation in gleaning and tourism-sector livelihoods. See Appendix E for distribution of gleaners in single or multi-gleaner households.

It is important to note that proximity to gleaning habitat can affect participation cannot explain the differences in participation across communities in Bahía Málaga. Mangaña and La Plata have similar access to extensive harvest areas but had significant differences in participation rate. La Sierpe and Miramar are located next to each other but had different

rates of participation, and both were higher than in La Plata, despite having less immediate access to harvest areas. Of the three beachfront communities, La Barra has the most extensive access to harvest areas, which may contribute to its higher rate of gleaning participation but does not explain its complete absence in Ladrilleros or Juanchaco, where gleaning used to be practiced and is piangua is still consumed.

b. Gleaner Demographics

Gleaner demographics also differed across the communities. Although men and women both reported gleaning in Bahía Málaga, women had higher rates of participation and the difference in participation rate between men and women was larger in communities with more tourism. The difference in participation rate was negligible in Mangaña, but in La Plata and La Barra, women participated at rates 2.7 and 4.7 times higher than men, respectively (Figure 15). Considering gleaner age reveals further differences. Adult women were the largest demographic across communities and made up a significant majority in communities with more tourism, due primarily to lower participation among adult men (Figure 16). Adult men made up nearly a third of gleaners in the early-stage communities but accounted for only 11% in La Plata and were absent in La Barra. There was little difference in participation among adolescent males, who accounted for around 22% of gleaners in the region. This suggests that tourism development is associated with declining participation in gleaning that occurs first among adult men, most of whom leave during the early stage of tourism development, followed by women and adolescents, who leave during the middle stage.

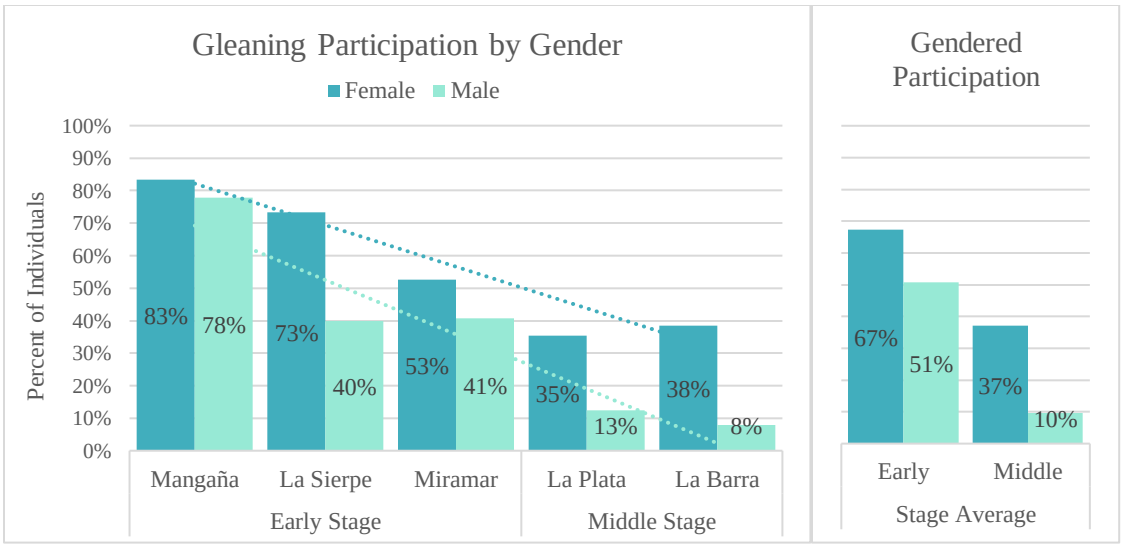

Figure 15: Female and male gleaning participation among individuals that reported livelihood activities. See Appendix H for breakdown by gender and age.

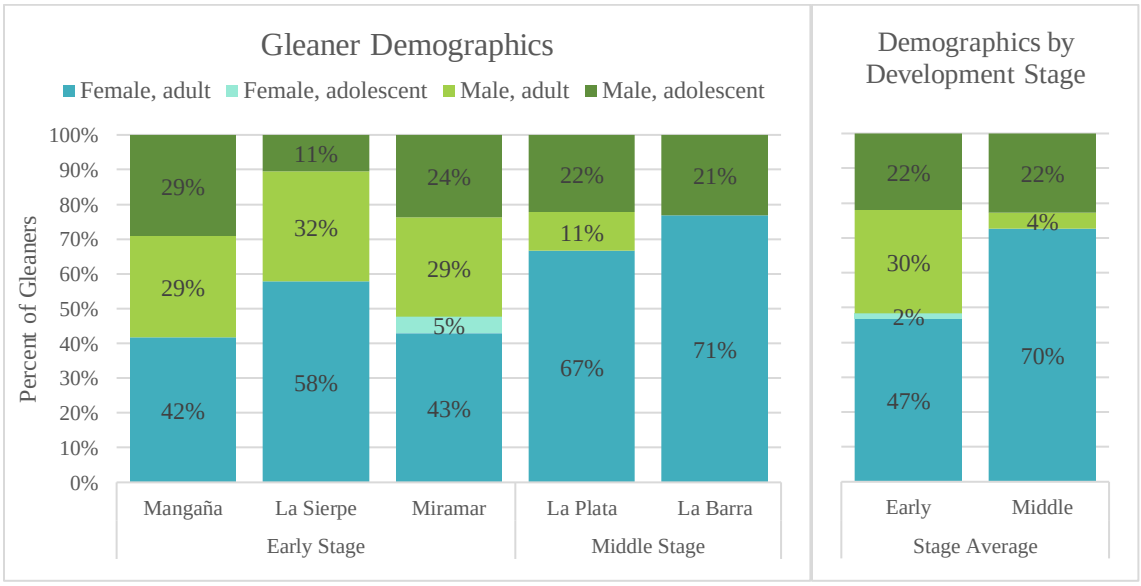

Figure 16: Proportion of gleaners in each demographic group based on age and gender, where adult indicates anyone living independently or at least 20 years of age.

c. Sale and Consumption of Gleaning Harvest

The majority of gleaning harvests from Bahía Málaga were sold, and this was especially true in communities with less tourism development, where only 10-15% of the harvest was consumed at home or gifted within the community (Figure 17). In comparison, 20-30% of harvests were consumed or gifted in middle-stage communities, indicating either that

gleaning households were consuming a higher volume of piangua or that harvests were smaller, so the same consumption accounted for a larger share of the harvest. When asked about household diets, very few gleaning households (8%) reported consuming piangua in the past week, supporting the finding that it is engaged in primarily as an income generating activity. Despite the variation in the reported location of sale (locally, in neighboring communities, or in Buenaventura), the majority was destined for export to Ecuador via buyers in Buenaventura, often through a local intermediary buyer. Only a small portion was sold for local consumption (only 6% of all surveyed households reported consuming piangua in the past week), mostly in Ladrilleros and Juanchaco where piangua had been part of traditional diets but was no longer harvested locally.

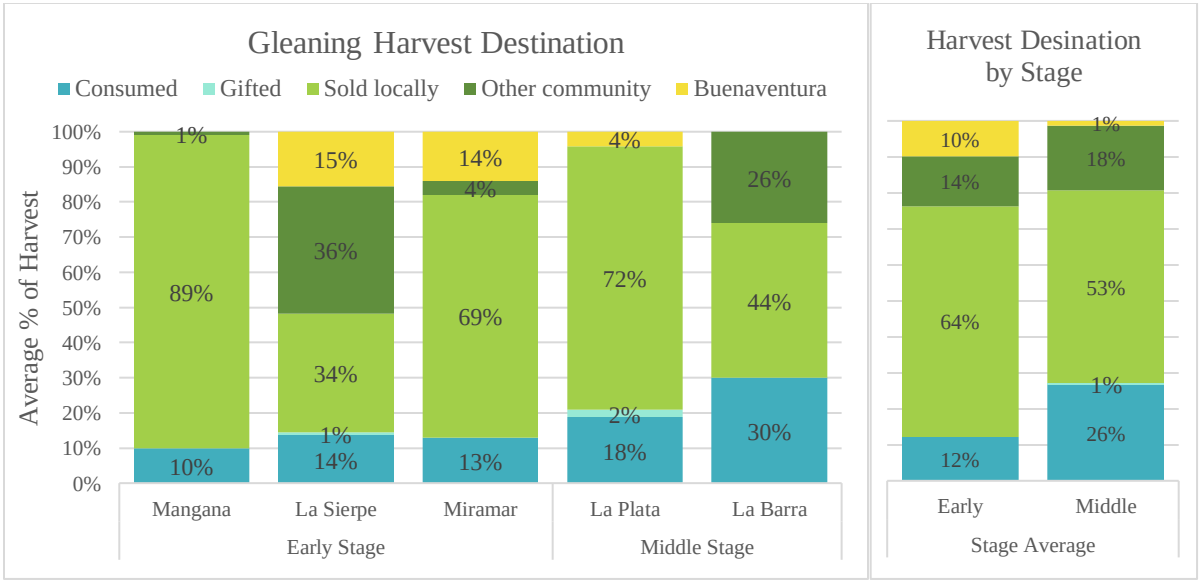

Figure 17: Sale and consumption of gleaning harvests.

2. Tourism Impacts on Gleaning versus Fishing

The decline in participation in gleaning in the communities of Bahía Málaga mirrors declines in participation in other natural resource-based livelihoods, including fishing, logging, farming, hunting, and gravel mining. Participation in these activities was lower in

communities with more tourism (Figure 18). This aggregate analysis supports the finding that opportunities in tourism livelihoods lead to declining participation in natural resource-based livelihoods. This pattern was consistent in individual-level participation and when adjusted to reflect average effort among individuals (see Appendix E). However, gleaning is unusual as the only natural resource-based livelihood that was completely absent in the late-stage communities. The following section examines differences between gleaning and fishing in order to better understand how and why gleaning is the only livelihood that disappears and how the socio-ecological characteristics of livelihoods mediate the effects of tourism development.

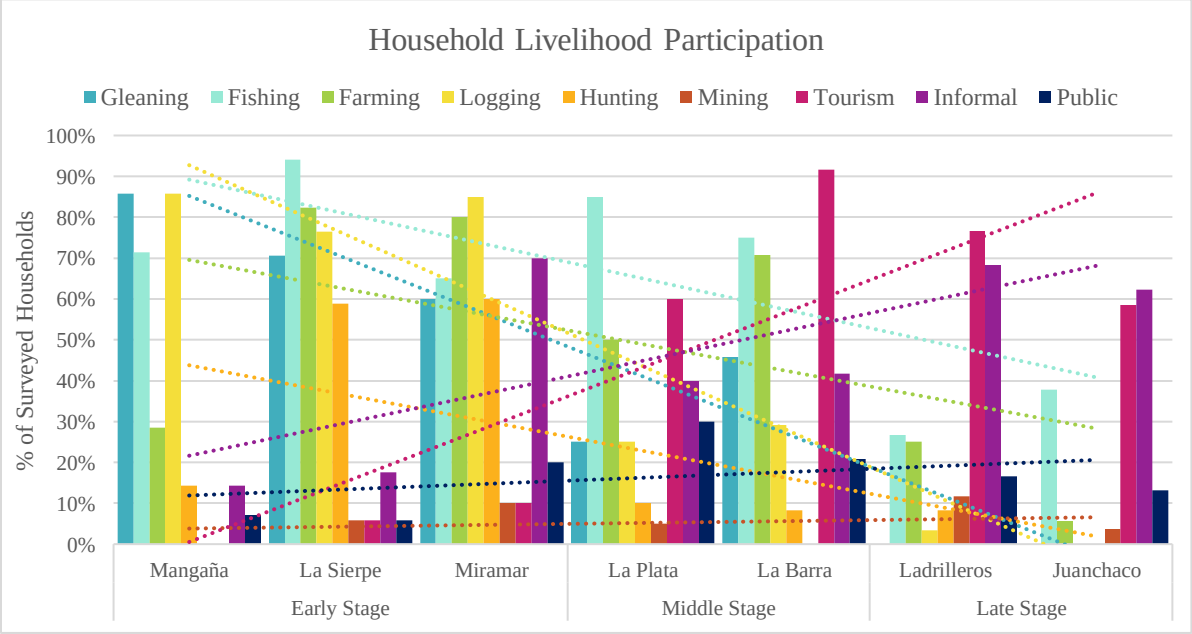

Figure 18: Household livelihood participation in each major livelihood sector. Similar patterns exist in individual-level participation (see Appendix E).

In Bahía Málaga, tourism impacts on gleaning differed significantly from impacts observed in the fishery, with significant implications on the harvest pressure on the two marine resources. Participation rates declined in both livelihood sectors as tourism increased, but fishing was still practiced by roughly a third of households in the late-stage communities,

where gleaning was entirely absent (Figure 19a). The difference in average livelihood effort among fishers and gleaners was particularly significant, because while average gleaning days per month were similar across communities where it was practiced, fishing effort was *higher* in communities with more tourism (Figure 19b)[13]. Combining community-wide participation with average effort provides a measure of community-wide harvest pressure, shown as per-capita to allow for comparison between communities of different sizes (Figure 19c). Community-wide harvest pressure from gleaning was lower with more tourism development, driven by declining rates of participation. Fishery harvest pressure, on the other hand, varied between communities but showed no clear trend of increase or decrease with more tourism development because greater effort counteracted the impact of lower participation.

Furthermore, while there was little variation in gleaning harvest method or catch rate, fishers in communities with more tourism development also reported more powerful equipment that was associated with higher average catch rates, which when included, revealed that community-wide fishing pressure actually was highest in communities with more tourism development (Figure 8). Together these patterns show that, in contrast to gleaning, which declined in engagement and importance as tourism developed until it disappeared altogether, tourism development was associated with intensification and specialization among a smaller group of fishers, who on average also reported higher livelihood importance of fishing (see Chapter 3, Figure 11) and sold a larger share of their catch (Appendix I).

[13] Ladrilleros is an exception to this pattern, largely due to environmental disturbances that forced the community to relocate off the beach during the same period that tourism was developing, which reduced access to the fishery and shifted even more livelihood effort towards tourism and other sectors, even among households that still reported fishing. See Chapter 3 for more detailed discussion.

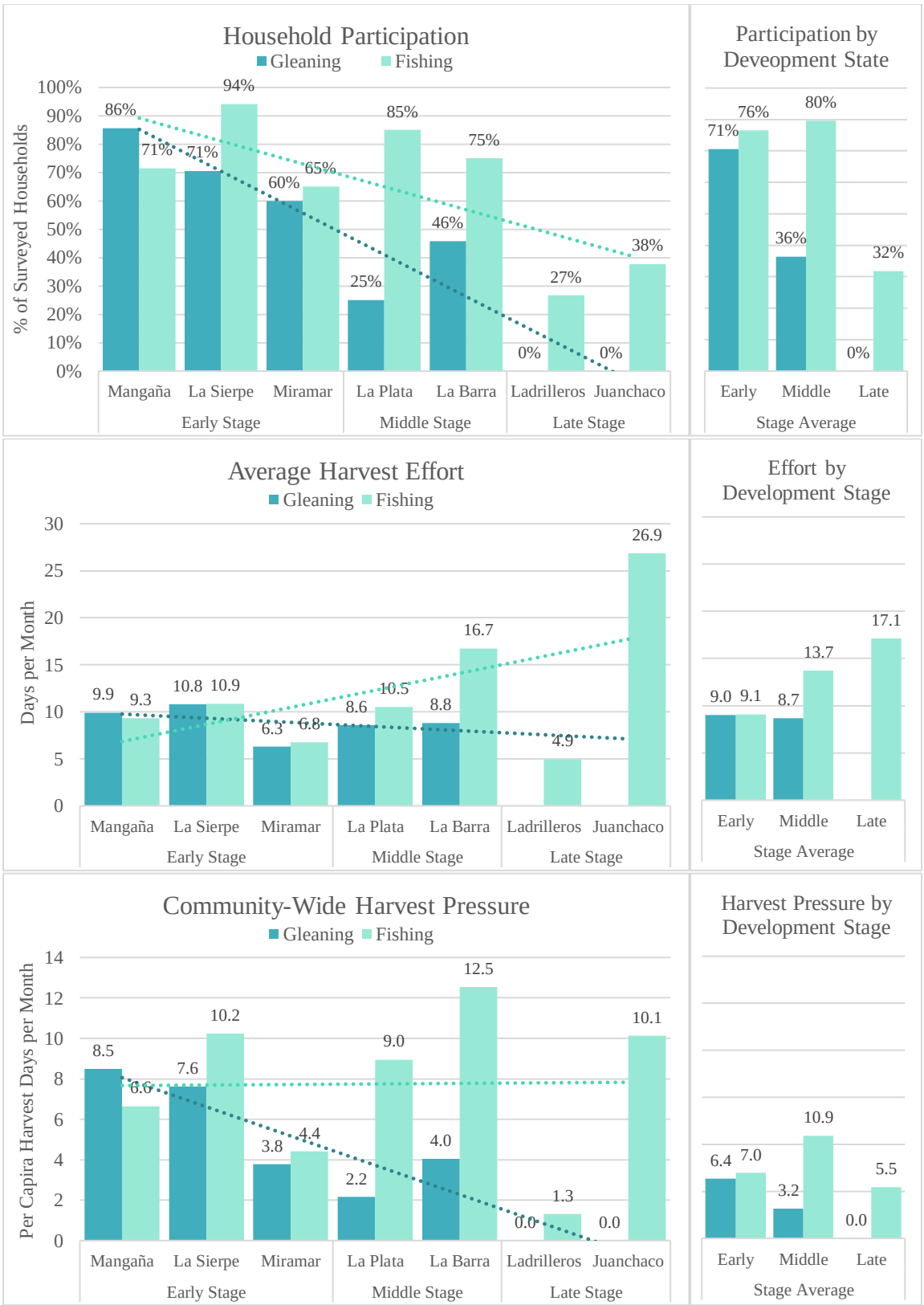

Figure 19: Comparison of gleaning and fishing in Bahía Málaga: (a) Percent of surveyed households that participated in gleaning and fishing. (b) Average gleaning and fishing effort in days per month among

gleaning and fishing households. (c) Community-wide per capita harvest pressure in gleaning and fishing. Measured in days per month and calculated among all surveyed households. Striped bar reflects per capita fishing pressure that has been adjusted to reflect the influence of fishing method on total fishing pressure (see Chapter 3).

E. Discussion

1. Tourism-Driven Decline in Gleaning Activity

Differences in gleaning engagement between the seven communities suggest that tourism development contributes to a decline in participation and importance of gleaning and results in the abandonment of gleaning livelihoods. This shift is related to an increase in livelihood opportunities associated with tourism development, but it does not occur evenly throughout the community. Rather, adult men were the first to exit gleaning livelihoods; they gleaned in the early stage but were nearly absent in middle stage. They were followed by women and adolescents, who stopped gleaning between the middle and late stages. These differences relate to the gender dynamics of gleaning and tourism livelihoods and can be better understood in the broader context of piangua harvests in the Colombian Pacific.

Gleaning in the **early-stage communities** was consistent with patterns of gleaning documented elsewhere in the Colombian Pacific around the time of research and was reflective of the influence of the export market for piangua in Ecuador (Otero Benavides, 2015; Prado-Carpio *et al.*, 2018; Barrero-Amórtegui and Maldonado, 2021). Both men and women participated in gleaning, sold the majority of harvests, and reported relatively high importance of gleaning relative to other household livelihoods, which deviated from traditional patterns of resource use where gleaning was done primarily by women and adolescents and a larger share of harvest went towards subsistence than sale to market. These differences stem from the economic opportunity created by the Ecuadorian market, which led to greater harvest and export among women and also an increase in men's participation,

especially where other income-generating opportunities were limited or had declined, such as from the collapse and closure of the shrimp fishery (Otero Benavides, 2015; Barrero-Amórtegui and Maldonado, 2021). As a result, even though the piangua population in Bahía Málaga was among the healthiest in the region (Tilley and Box, 2014), Lucero et al. (2012) reported evidence of overexploited stocks in the bay and throughout the region.

As tourism development expands in **the middle stage,** so too do the associated economic opportunities, which facilitate a decline in gleaning participation and importance. Adult men were the first to stop gleaning as tourism provided other options. This makes sense given that gleaning is viewed as "women's work" and men's participation was primarily motivated by a lack of economic alternatives. However, gendered differences in livelihood opportunities associated with tourism also contributed departure of men from gleaning by the middle stage. Livelihoods in the early and middle stage are more likely to be available to men due to existing gendered division of labor.[14] For example, men will do the majority of work in construction, are more likely to have the equipment and skillset to work in transportation or tour guiding, and have more cultural latitude to work outside the home and interact with tourists. Participation rates also decline among adult women at this stage, but because tourism is less consistent and new livelihoods are still limited in the middle stage, diversified livelihoods strategies are common and many women and adolescents continue to glean with similar effort levels as reported in the early stage communities.[15]

[14] Men will be the ones to work in construction (physical strength), have the equipment and skillset to work in transportation or as a tour guide, and are more likely to work outside the home, be available to take advantage of opportunities, and have more cultural latitude to interact with outsiders.

[15] However, because gleaning effort is limited by the tidal cycle, it is possible to engage in other livelihoods without reducing gleaning, so similar effort levels in gleaning does not

These demographic shifts in gleaning also help explain the shift in harvest destination and decline in importance of gleaning. When men stop gleaning there are fewer multi-gleaner households, which results in smaller household-level harvests. This lowers gleanings contribution to the household, and if in-home consumption stays the same, will increase the percent of harvest that is consumed. These changes alongside the addition of new income streams lower importance of gleaning relative to other household livelihoods. However, this shift may also reflect cultural biases in the valuation of labor that tend to view men's livelihoods as the most important and undervalue women's labor and contributions to the household (e.g., Falanruq 1992 in (Williams *et al.*, 2002)).

Indeed, qualitative data from the household survey and follow-up interviews suggested that although gleaning did not contribute the most income to the household, it played an important role in the day-to-day resilience of the household. Although profit margins are low, gleaning harvests are accessible (don't require gear or gasoline, nearshore, low risk environment), consistent and predictable (depends on time spent – limited by tides, and health of the resource/resource density), and can provide food or income when its needed (ability to harvest and store at low tide line means piangua can be eaten, saved, traded, or sold).[16] Gleaning piangua is so reliable that it can be used to secure credit in the local store

mean similar livelihood engagement in other sectors. For example, many gleaners in La Barra reported working in tourism on the weekends and gleaning on the weekends.

[16] However, the ability to sell or trade piangua is largely dependent on the market in Ecuador, which creates other vulnerabilities. Many households reported that the greatest times of food insecurity and economic stress occur when strikes or protests disrupt roads along the trade route to Ecuador and restrict access to these buyers. Piangua can still be gathered for subsistence, but cant be traded for oil, flour, sugar, etc.

with the assurance that they were going gleaning and would pay for the goods with their harvest when they returned.

> "La importancia de la piangua es lo que mas da lo economico, es decir que da cada cuanto que lo necesita. Por ejemplo, si alguien te quiere prestar y dice que ya se van a pescar y te pagan - uno no sabe si te van a pagar o no, pero si dicen que van a pianguar, no hay problema en prestarles porque saben que van a traer la plata. La madera solo paga una vez de han cortado, sacado y vendido la madera, la pesca a veces no da, pero la piangua siempre." (Miramar community leader, 8/13/2017)

By the **late stage of tourism development**, the expanded volume and stability of tourism-related opportunities, especially those that are accessible to women, led to a complete abandonment of gleaning livelihoods. While opportunities in the early and middle stage were better aligned with men's labor, opportunities related to hospitality in hotels or food service are better suited to women's availability and experience and increase in the late stage as more established tourism operations replace local facilities and services. This facilitates the same shift in labor among female gleaners that was seen among men in the middle stage and ultimately results in the abandonment of gleaning. In addition to the pull factor of new livelihoods, decreasing participation in gleaning at the community level also contributes to push factors that can accelerate the abandonment of gleaning. Gleaning is very accessible but relies on socio-ecological and socio-cultural knowledge to harvest, is traditionally engaged in as a group activity, and relies on intermediaries to reach profitable export markets. Thus, as tourism develops and participation declines, gleaning can become harder to practice and sell. Ultimately, the characteristics that make gleaning so valuable for rural households' adaptability and resilience also contribute to the abandonment of gleaning.

2. Socio-Ecological Characteristics of Livelihoods Mediate Tourism Impacts

The two main marine resource-based livelihoods, fishing and gleaning, had very different responses to the development of tourism in the communities in Bahía Málaga. While

development was associated with a decline in participation in both fishing and gleaning, responses diverged as some fishers became more specialized and intensified in the middle and late stages while gleaning was abandoned as a livelihood all together. This divergence is related to differences in how tourism impacts the opportunities and profitability of each sector and differences in livelihood preferences and perceptions of fishing and gleaning. These differences in turn are shaped by livelihood characteristics, especially market opportunities, harvest techniques, resource characteristics, market opportunities, and socio-cultural dynamics of labor of piangua gleaning versus fishing.

Fishing and gleaning target different resources (habitat, mobility, and life history), in different locations, using different techniques. The livelihoods have different labor characteristics (e.g., duration, difficulty, risk-level, physicality of labor), different demographic composition, and often have specific socio-cultural associations. Harvests are used and sold in different quantities and in different markets. Gleaning primarily targets sessile or low-mobility marine invertebrates that are harvested by hand using only rudimentary tools (e.g., a stick or knife, gathering basket) from shore or shallow waters (mangroves, mudflats, tide pools, etc.). Gleaning areas are reached by canoe or on foot so access is shaped by temporal considerations of the lunar calendar and tidal cycles. Fishing, on the other hand, primarily targets bony fish species found in the estuaries, nearshore waters, and open ocean. It is equipment-dependent — requiring at least one type of fishing gear (hand lines, long lines, or nets (cast nets, gill nets, trawl nets, shrimping nets, etc.), usually a vessel of some kind, and often a outboard motor and gasoline. It can require considerable physical strength (e.g., ability to haul boats onto beach and carry motors - cite)

and is practiced farther away from home with greater risk — all of which contribute to it being a male-dominated activity in many parts of the world.

One of the main drivers of change in the fishery is related to how tourism development increases market opportunities by expanding local demand (restaurants) and improving infrastructure and services, such as electricity and refrigeration, which facilitate accumulation and/or export of fishery catches without additional processing. However, these changes have less effect on gleaning because the most profitable export markets are in Ecuador, so increases in local demand have little effect on economic opportunity. Improvements in refrigeration do not have as important an effect either since piangua can be kept alive without refrigeration or processing and their shells can withstand transportation. As a result, tourism livelihood benefits are concentrated outside of gleaning, but expand opportunities outside of *and within* the fishery.

These expanded opportunities and increased cash flow allow fishers to intensify fishing by investing in better boats, motors, and gear, resulting in increased catch rate (catch per unit effort, or CPUE). Fishers in Bahía Málaga that used larger boats and more powerful motors reported daily catches that were, on average, 3.5 times greater than those fishing without a motor (Chapter 3 and Appendix D). However, differences in harvest techniques and resource characteristics limit gleaners ability to intensify or increase profitability of gleaning. The *manual harvest techniques* used in gleaning cannot be easily mechanized or modernized, creating an upper limit to of catch rate that can only increase with higher density of piangua. Better transportation can theoretically expand access to richer gleaning areas, but the added cost of gasoline takes away from the already small profit margin. The sedentary nature of piangua and most gleaned species make them especially vulnerable to over harvesting, so

increased harvest can quickly deplete harvest areas and reduce the harvest rate. Lastly, gleaning effort is also limited by the tidal cycle that determines access to the resource, so while fishers reported fishing up to 30 days a month, the maximum gleaning effort in Bahía Málaga was 20 days/month.

Limits on the profitability of gleaning is a major factor in shaping household livelihood decisions, but *differences in the labor, lifestyle, and socio-cultural perceptions associated with each livelihood* also play an important role in shaping livelihood preferences. Gleaning is generally viewed as a lower status livelihood, in part due to the difficult, uncomfortable nature of labor and is traditionally practiced by women and seen as "women's work," so personal preference and social perceptions also contribute to the shift to new livelihoods, in particular among men. In contrast, fishing has a higher social status and is seen as traditionally men's work. Although women often fish alongside gleaning (see Appendix H) fishery became more specialized (and gleaning declined), it became more male-dominated and full-time, intensified fishing was practiced exclusively by men.

3. Implications, Alternate Outcomes, and Opportunities

Reduction in gleaning can reduce resource pressure and represent a shift to more preferred and profitable livelihoods, but loss of gleaning livelihoods leads to loss of socio-cultural practices and ecological knowledge and can jeopardize household and community resilience, especially in rural regions with limited infrastructure and emerging tourism-dependent economies that have seasonal variation and are sensitive to external shocks (economic, geopolitical, climactic) that affect the number of tourists. Additionally, given the role of gleaning and gleaners in the ecosystem, loss of gleaning livelihoods could disrupt

traditional territorial management practices, leaving mangrove ecosystems more vulnerable to degradation or loss or exploitation by resource uses form outside the community.

Accordingly, best practices for most benefits from tourism development should look for opportunities to preserve and continue gleaning practices and incorporate into tourism section. The community of La Plata, in the middle stage of tourism development, provides an example of this approach through the *Ruta de la Piangua*, which links gleaning and tourism through eco- and ethno-tourism. Tourists accompany gleaners to the mangrove to learn about the ecosystem and harvest practices and return to learn how to prepare piangua (Velez, 2014; Lobo, Vélez and Puerto, 2015; Lobo, Velez and Puerto, 2016). This combines mangrove ecotourism with ethnotourism of working landscapes, rural livelihoods, and culinary traditions to provide an additional income stream for gleaners without increasing harvests. At the same time, it helps ensure the continued practice and protection of gleaning livelihoods and resources. La Plata has had high rates of compliance with the minimum harvest size, voluntarily designated rotating harvest zones and implemented seasonal closures, and contribute to ongoing monitoring and study of the ecosystem (Velez 2009), all of which contributed to the highest piangua densities and harvest rates in the region (Tilley and Box, 2014), despite signs of overexploitation documented in data from 2005-2007 (Lucero, Cantera and Nelra, 2012). This outcome was made is possible, in part, because La Plata has collective land and resource rights, cooperative governance, and intentional tourism planning based on knowledge of development experience in neighboring communities (what they want and don't want, what not to do) as well as influential role of dedicated local leadership. However, La Plata was in the middle stage of development at the time of research and could still end up abandoning gleaning, however the intentional integration and commitment to

preserving traditional livelihoods alongside tourism makes it likely that gleaning will change but not disappear.

This example highlights the potential and value of connecting traditional livelihoods and tourism in order to maximize the social, economic, and ecological benefits of both, which if done carefully, can reinforce local conservation and management efforts and increase local income while preserving cultural traditions and the resilience afforded by maintaining these sources of food and income. This supports the arguments that tourism development can be an opportunity for community development, but that local households fare best and will be buffered from some of the vulnerabilities created or exacerbated by tourism development when they maintain diversified livelihoods, shifting effort to new opportunities but continuing to engage in traditional livelihoods (Su, Wall and Jin, 2016).

F. Conclusion

In Bahía Málaga, gleaning is an important part of diversified livelihoods that is especially valuable for household and community resilience, yet as tourism develops, participation in gleaning declines and is abandoned once tourism is well established in the late stage of development. The disappearance of gleaning reflects livelihood preferences that favor alternatives that are more profitable, convenient, and held in higher social esteem. The characteristics of gleaning that make it among the first to be abandoned also make it one of the easiest livelihoods to take up again as needed, but its disappearance from entire communities will make it harder to access as traditional harvest practices and ecological knowledge are lost. So, while tourism development facilities a transition to more profitable and preferred livelihoods, to the extent that it leads to the loss of gleaning it may also

increase household and community vulnerability by removing an important tool for meeting needs in times of scarcity or instability.

However, gleaning is only half of traditional marine resource-based livelihoods, and tourism development impacts on fishing lead to a very different outcome. Fishing livelihoods shows a similar pattern of contraction as tourism development, but rather than disappear, the fishery becomes increasingly specialized and intensified. These divergent outcomes can be explained by characteristic differences between gleaning and fishing livelihoods, such as the barriers to intensification of manual harvesting techniques and different resource limitations of sessile invertebrates versus mobile finfish, as well as site specific factors, such as the existing market conditions. Variation in these site or species-specific factors could lead to different outcomes in other scenarios. For example, if tourism demand led to an increase in sale prices or market opportunity for piangua, as it did in the fishery, then tourism might have led to more continuous participation, increased harvests, and greater likelihood of overexploitation of the resource.

These findings draw attention to the significant differences between fishing and gleaning and the diversity within small-scale marine resource sectors in terms of resource characteristics, harvest technique, and livelihood practices, as well as how they respond to tourism development and the role they play in the community. Ignoring these differences can lead to mismanagement, increased vulnerability, and ecological harm, so there is a need to recognize fishing and gleaning separately in research, planning, and policy. This highlights the need for specific consideration of gleaning within coastal development planning and marine resource management, as well as dedicated research on the overlapping but distinct roles of fishing and gleaning, and more inclusive, disaggregated data collection within small-

scale fisheries research in order to capture the full range of marine resource-based livelihoods. Findings more broadly point how development impacts can vary widely within categories of resource-based livelihoods so greater attention is needed to factors such as the demographics of resource-users, harvest techniques and limitations, market conditions, and socio-cultural perceptions in order to better anticipate and understand how development will affect them and to identify risks and opportunities.

Although tourism development can jeopardize gleaning resources and livelihoods, compared to other more destructive forms of development, it also presents the most likely opportunity for long-term socio-ecological health and sustainability. Integrated development planning and resource management are needed to achieve these benefits. The best outcomes are likely to result from livelihood diversification but not replacement so care should be taken to protect and preserve gleaning livelihoods to support economic resilience, long-term food sovereignty, and ecological sustainability. Maintaining gleaning will require (a) secure access and resource rights for local community, (b) preservation of socio-ecological knowledge of resources and harvest techniques, and (c) ecosystem-level protections and regulation of resource harvesting.

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Appendix

A. Description of Tourism Development Stages

Table 4: Tourism Development Stages, adapted from Butler's Tourism Area Lifecycle Model (1980).

Simplified Stages	Butler's Stages	Stage Descriptions
EARLY	Exploration	Irregular visits from adventurous tourists that are attracted to natural or cultural features. No specific facilities (i.e., hotel, restaurant) available so contact with residents is high, but there is relatively little social or economic significance of arrivals and departures due to small numbers and physical space and social norms are mostly unchanged.
	Involvement	The number of visitors increases, with some organization of travel arrangements and emergence of tourist season. Some residents provide facilities for tourists so contact with residents remains high. Beginning of pressure on government to improve transport and other facilities.
MIDDLE	Development	Steep increase in number of tourists leads to noticeable changes in physical space and social norms. Local involvement and control of development declines rapidly as locally provided facilities are replaced by larger, more elaborate facilities owned by outside organizations.
LATE	Consolidation	Visitor number increase to equal or exceed residential population and outside organizations have a significant presence. Tourism forms a major part of local economy and may interfere with non-tourism related activities. Socio-cultural and physical changes are widespread and there is increased likelihood of opposition among some residents.
	Stagnation	The high number of tourists strain local capacity and create social, economic, and environmental problems. Destination is well-known but social status is slipping and attractions may have lost some of their appeal. Efforts must be made to attract enough tourists to fill facilities, with heavy reliance on repeat visitation.
Rejuvenation or Decline		Decline if the area cannot compete with nearby attractions, property turnover will be high, tourist facilities may be replaced by non-tourism related uses. Rejuvenation if new attractions can draw different tourists and expand tourist season, may be supported by private or government efforts.

B. Characterization of Fishing in Bahía Málaga

In Bahía Málaga, fishing is done from shore or in canoes and small boats (Figure 20). Canoes are traditionally made of wood and propelled by paddle, though recently fiberglass canoes are more common as is the use of motors between 2 and 15 horsepower. Fishing boats are made of wood or fiberglass and are usually between 6-8 meters. They have open decks and use outboard motors, most commonly 15 or 40 horsepower (Figure 21).

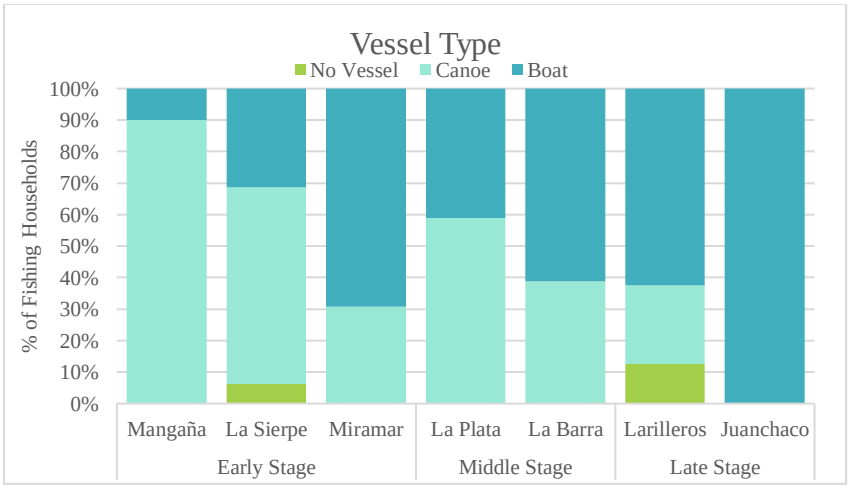


Figure 20: Percentage of surveyed fishing households that reported fishing by boat, canoe, or from shore without a vessel.

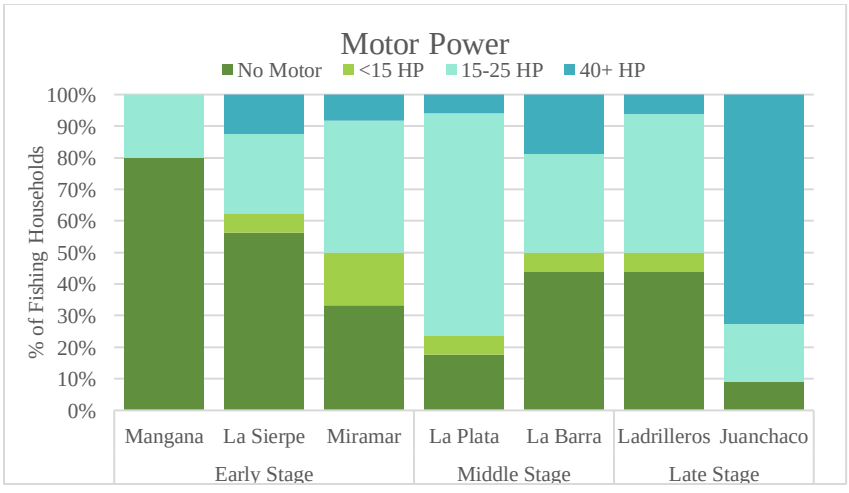


Figure 21: Motor usage and strength among surveyed fishing households.

There were three major gear types in Bahía Málaga — nets of various mesh sizes, hand lines, and long lines – and they were used widely in all communities regardless of vessel type or motor power (Figure 22). Other gears included cast nets, shrimp nets, beach seine nets,

bottom trawlers, and harpoon/speargun. Half of all fishing households reported 1 gear type, 36% reported 2, and 12% reported 3 (Figure 23). Only 2% of fishing households reported 4 or 5 types and all were in Juanchaco, which was the only community that reported all gear types.

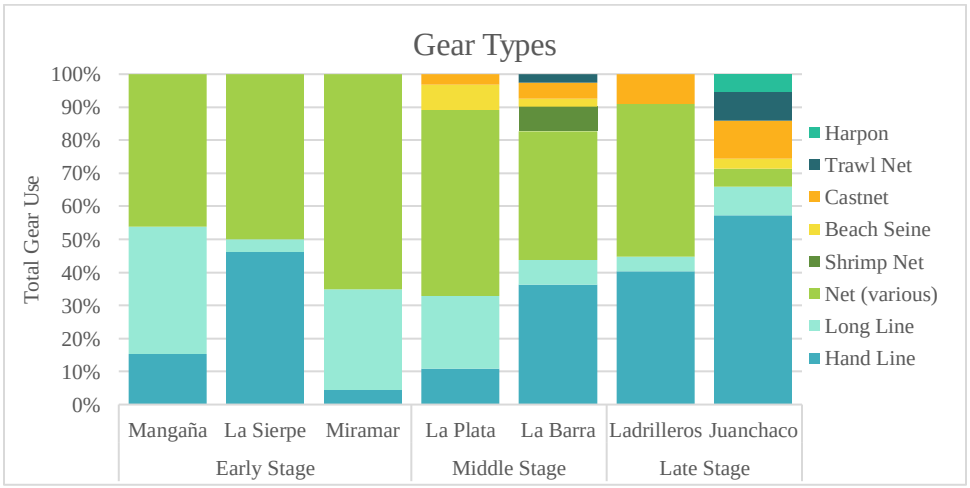


Figure 22: Relative percentage of gear usage by type.

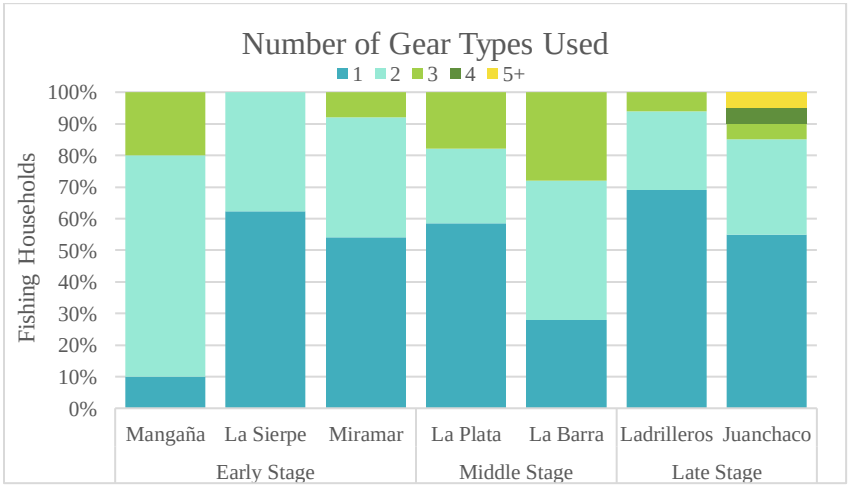


Figure 23: Number of fishing gear types used among surveyed fishing households.

Fishing in the area is also done by larger vessels called wind-sea boats but are not included in this data because they come from communities to the south. These boats are longer, use higher power motors and/or multiple motors, and are equipped with a tarp-covered sleeping platform that allows 1-5 people to fish day and night, usually for 8 days at a time. They often travel in groups of 2 to 10 boats, and fishing is done primarily with drift nets (using up to 20 nets at a time).

C. Translated Household Survey Questionnaire

Community:
Date:
Surveyor:

Has the participant received information about this research and given their consent to patriciate?
yes // no

Observations of Material Conditions of the Home

1. Number of floors: _____
2. Material of floor earth // wood // cement // tile // other: _____
3. Material of the walls wood // wood and bricks // bricks // other: _____
4. Material of the roof palm thatch // plastic // metal sheet // composite tiles // other: ___
5. Additional comments: _____

The Household

6. Who *currently* lives in this household? Please start with yourself and then your partner and other members of the household, if applicable. Include complete names, as well as age, gender, and relationship to respondent in the table below.

	Name	Age	Gender	Relationship to survey respondent
1				01
2				
3				
4				
5				
…				

01 Survey respondent
02 Spouse or partner
03 Child
04 Stepchild
05 Parent
06 Sibling
07 Grandchild
08 Grandparent
09 Niece or nephew
10 Brother or sister-in-law
11 Mother or father-in-law
12 Other family member
13 Other non-family member
14 Other: _____

7. If you live with your partner, how many years have you lived together? _____
8. Do you or your partner have children that do not live with you? If yes, list their age, gender, where they live, how long since they moved out, and if they are the child of you, your partner, or both in the table below.

Age	Gender	Where do they live?	How long since they lived in the household?	They are the child of:		
				Both	Female partner	Male partner

Subjective Wellbeing

9. Considering all things together, how satisfied are you with your life in general?
   Totally unsatisfied (0) // 1 // 2 // 3 // 4 // 5 // 6 // 7 // 8 // 9 // totally satisfied (10)
10. Imagine a ladder with each rung labeled from 0-10. At the top 10 represents your best possible life and at the bottom 0 represents the worst.
    (a) What step would you say that you are on now?
    Worst possible (0) // 1 // 2 // 3 // 4 // 5 // 6 // 7 // 8 // 9 // best possible (10)
    (b) What step do you think you will be on in 5 years?
    Worst possible (0) // 1 // 2 // 3 // 4 // 5 // 6 // 7 // 8 // 9 // best possible (10)
11. Now I will ask about how you have felt over the past week (previous 7 days). How often did you feel the following emotions or moods:
    (a) Happy? almost never // seldom // sometimes // often // almost always
    (b) Content? almost never // seldom // sometimes // often // almost always
    (c) Tranquil? almost never // seldom // sometimes // often // almost always
    (d) Sad? almost never // seldom // sometimes // often // almost always
    (e) Angry: almost never // seldom // sometimes // often // almost always
    (f) Stressed? almost never // seldom // sometimes // often // almost always

The House

12. Do you own the house where you are living? yes // no
    If no, who owns it? family // community member // tourist // other
    Do you pay rent? yes // no
13. How many years have you lived in this house? _____
14. Do you have a business in your home? yes // no
    If yes, what is the business? _____
15. Do you or someone in your household own another house or apartment? yes // no
    If yes, where? _____
16. Electricity questions depend on community:
    For Juanchaco, Ladrilleros, and La Barra
    How much did you pay for electricity last month?
    No electricity // <$25 mil COP // $25-50 mil COP // $51-100 mil COP // >$100 mil COP
    For La Plata, Miramar, La Sierpe, Mangaña, and Chucheros
    Do you have electricity in your house? yes // no
    (a) Who owns the generator? Personal // shared // community // other
    (b) On average, how many hours do you have electricity per day?
    1-2 // 3-4 // 5-6 // 7-8 // 11-12 // 12+
17. How often do you cook with gas?
    never // sometimes // half of the time // most of the time // always
18. How many of the following items do you have or own within your household:

Refrigerator/freezer	Computer	Boat or canoe
Washing machine	Smart phone or tablet	Boat motor
TV	Cell phone (basic)	
DVD player	Motorcycle or car	

Land Use

19. Answer the following questions for each area of land that is owned or used by your household:

(a) How did you come to own or use this land?
claimed // inherited // given by the community // gifted from the owner // purchased
(b) How is this land titled?
collective title // individual title // individual title pending // informal
(c) What percentage of the land is: planted? __ cleared? __ thinned? ___ forested? ___
(d) How do you get to your land? by foot // by canoe // by motorboat
(e) How long does it take to get there from your home? _____

20. *For Juanchaco, Ladrilleros, and La Barra only*
Has anyone in the household bought or sold land in the community?
bought: yes // no sold: yes // no
If yes, how was it titled before? _____ After? _____
Who was it bought from or sold to? community member // tourist
21. In the past 12 months have you or anyone in your household cleared land? yes // no
If yes, why? To plant // to build // to (re)claim territory // other: _____

Livelihoods

22. How many household members regularly engaged in some form of work? _____
23. What livelihoods have each member of your household engaged in over the past 12 months?

	Household Member	1	2	3	4	5	…
	Did they have a full-time position?	y / n	y / n	y / n	y / n	y / n	y / n
Natural Resource Sector	Fishing						
	Gleaning						
	Farming						
	Logging						
	Domestic animals						
	Gravel mining						
	Over the past 30 days, how many days did they work in the natural resource sector?						
Tourism Sector	Hotel						
	Restaurant/bar						
	Renting rooms or camping						
	Tour guide						
	Tip-based services						
	Beach vendors						
	Making and selling local crafts						
	Sport fishing						
	Over the past 30 days, how many days did they work in the tourism sector?						
Secondary Sector	Transportation						
	Construction						
	General store/sales						
	Sawmill						
	Mechanic						
	Baker						
	Barber						
	Loading/unloading						
	Healer						
	Over the past 30 days, how many days did they work in the secondary sector?						

Public Sector	Education						
	Health						
	Police or Military						
	Government Agencies (i.e. National Park)						
	Public Utilities						
	Childcare						
	Churches						
	Over the past 30 days, how many days did they work in the public sector?						
	Other:_____						

24. Of the livelihoods reported above, which are the most important to your household?
    (a) In general: First _____ Second _____ Third _____
    (b) In terms of income generation: First _____ Second _____ Third _____
    (c) In terms of time spent: First _____ Second _____ Third _____
25. What percent of your household-diet comes from each the following activities?
    (a) Fishing: _____%
    (b) Gleaning: _____%
    (c) Farming: _____%
    (d) Hunting: _____%
    (e) Domestic Animals: _____%
26. How does your household's participation compare relative to 5 years ago?
    (a) Fishing: much less // less // no change // more // much more // NA
    (b) Gleaning: much less // less // no change // more // much more // NA
    (c) Farming: much less // less // no change // more // much more // NA
    (d) Logging: much less // less // no change // more // much more // NA
    (e) Hunting: much less // less // no change // more // much more // NA
    (f) Domestic Animals: much less // less // no change // more // much more // NA
    (g) Gravel mining: much less // less // no change // more // much more // NA
    (h) Tourism sector: much less // less // no change // more // much more // NA
    (i) Secondary sector: much less // less // no change // more // much more // NA
    (j) Public sector: much less // less // no change // more // much more // NA
27. Looking to the future, in 5 years how do you expect your household's participation to compare to your current participation?
    (a) Fishing: much less // less // no change // more // much more // NA
    (b) Gleaning: much less // less // no change // more // much more // NA
    (c) Farming: much less // less // no change // more // much more // NA
    (d) Logging: much less // less // no change // more // much more // NA
    (e) Hunting: much less // less // no change // more // much more // NA
    (f) Domestic Animals: much less // less // no change // more // much more // NA
    (g) Gravel mining: much less // less // no change // more // much more // NA
    (h) Tourism sector: much less // less // no change // more // much more // NA
    (i) Secondary sector: much less // less // no change // more // much more // NA
    (j) Public sector: much less // less // no change // more // much more // NA
28. Are there seasonal differences in when and how your household engages in any of these livelihoods? yes // no If yes, what are the seasons and how does participation change?

    _____

    _____

29. How do members of your household decide which livelihood activities they will engage in day-to-day? (i.e., personal preference, season or weather, opportunity, etc.)
    _____
    _____
30. Are there jobs that aren't available in the community but that you would like to have? yes // no If yes, what kind of jobs? _____

Natural Resource Use

Fishing

31. Does anyone in your household fish? yes //no
32. How do you/they fish?
    shore // canoe // small boat // "wind & sea" boat // large vessel // other
    For *each reported fishing method* –
    (a) Where do you/they fish?
        shore // estuary & mangroves // around the islands // rocks and reefs // open ocean
    (b) How many household members fish? _____
    (c) How many of the past 30 days has someone from your household fished? _____
    (d) What types of fishing gear are used? hook-and-line // long-line // drift net // bottom trawl // shrimp nets // cast net // beach seine // spearfishing
        Longline: How many hooks? _____ How many lines? _____
        Nets: How many nets? ___ How long are they? ____What is their mesh size? _____
    (e) If they fish from any kind of boat, how long is it? ____ (m)
        Does it have a sail? yes // no
    (f) Do they have a motor? yes // no If yes, how many horsepower? ___
    (g) Who does the fishing equipment that they use belong to?
        Gear: self-owned // shared or borrowed // rented // from the fish buyer
        Boat: self-owned // shared or borrowed // rented // from the fish buyer
        Motor: self-owned // shared or borrowed // rented // from the fish buyer
33. What is the average range of fish catch for your household in a given month? _____
34. Over the past year, on average, how much of the catch was
    (h) Consumed in the household: _____%
    (i) Gifted: _____%
    (j) Sold or traded in your community: _____%,
    (k) Sold or traded in a neighboring community: _____%
    (l) Sold or traded to a fish buyer: _____% Which one(s): _____
    (m) Sold or traded in Buenaventura: _____%
35. If you eat part of the catch at home, how do you decide which fish to eat and which to gift, trade, or sell? _____
36. Does anyone in the household participate in sport fishing (with tourists)? yes // no
    If yes, how many times in the past 12 months have you/they taken tourists sport fishing?
37. How old where you when you or your partner when they first began to fish? _____

Gleaning & Gathering

38. Does anyone in your household engage in gleaning or gathering? yes //no
    If yes, how many of the past 30 days has someone from your household glean? _____
39. Where do they glean (mangroves, beach, forest) and what plants and/or animals do you/they collect? _____
40. If anyone in the household gleans in the mangroves, do you have your own canoe? yes // no

41. Over the past year, on average, how much of the harvest was
    (a) Consumed in the household: _____%
    (b) Gifted: _____%
    (c) Sold or traded in your community: _____%,
    (d) Sold or traded in a neighboring community: _____%
    (e) Sold or traded in Buenaventura: _____%

Farming

42. Does anyone in your household farm or maintain cultivated crops? yes //no
    If yes, how many of the past 30 days has someone from your household farmed? _____
43. What do plants do you cultivate? _____
44. What is the average annual harvest? _____
45. Over the past year, on average, how much of the harvest was
    (a) Consumed in the household: _____%
    (b) Gifted: _____%
    (c) Sold or traded in your community: _____%,
    (d) Sold or traded in a neighboring community: _____%
    (e) Sold or traded in Buenaventura: _____%

Logging

46. Does anyone in your household practice logging? yes //no
    If yes, how many of the past 30 days has someone from your household logged? _____
47. *(Juanchaco, Ladrilleros, and La Barra only)* What kind of land do you/they log from?
    Household or family land // collective community land // other
48. How do you/they make money from logging?
    Selling timber // working in exchange for a portion of the timber // daily wage
49. Over the past year, on average, how much of the timber was
    (a) Used by the household: _____%
    (b) Sold or traded to community members: _____%,
    (c) Sold or traded to people from neighboring communities: _____%
    (d) Sold or traded to a sawmill: _____%
    (e) Sold or traded in Buenaventura: _____%

Hunting

50. Does anyone in your household hunt? yes //no
    If yes, how many of the past 30 days has someone from your household hunted? _____
51. Over the past year, on average, how much of the resulting bushmeat was
    (a) Consumed in the household: _____%
    (b) Gifted: _____%
    (c) Sold or traded in your community: _____%,
    (d) Sold or traded in a neighboring community: _____%
    (e) Sold or traded in Buenaventura: _____%

Domestic Animals

52. Does anyone in your household raise animals in your household? yes //no
    If yes, how many of each type of animal do you have and what do you do with them?
    (a) Chickens: _____ consume // sell // keep as pets
    (b) Pigs: _____ consume // sell // keep as pets
    (c) Ducks/geese: _____ consume // sell // keep as pets
    (d) Other: _____ consume // sell // keep as pets

Household Diet

53. Of all the food consumed in your household over the past 12 months, what portion was
    (a) self-produced: _____ %
    (b) gifted or traded from neighbors: _____ %
    (c) Purchased from a store: _____ %
54. Compared to 10 years ago, how has this changed?
    Now, we produce: much less // less // same // more // much more
    Now, we buy: much less // less // same // more // much more
55. What percentage of food consumed in your household over the past 12 months came from:
    (a) your community: _____ %
    (b) a neighboring community: _____ %
    (c) Buenaventura: _____ %
56. How many times in the past 7 days have the following types of protein been consumed in your household? Do *you* eat more or less of this food than you did 10 years ago?

Food	# in past 7 days	Compared to 10 years ago, currently you eat:
Fish		much less // less // the same // more // much more
Other Seafood		much less // less // the same // more // much more
Meat (from the store)		much less // less // the same // more // much more
Meat (raised at home)		much less // less // the same // more // much more
Bushmeat (hunted)		much less // less // the same // more // much more
Eggs, cheese, dairy		much less // less // the same // more // much more
Legumes (beans, lentils)		much less // less // the same // more // much more

57. Of the fish and/or seafood that has been consumed in your household over the past 7 days,
    (a) What was it and how much was consumed? _____
    (b) Where did it come from? Fishing or gleaning // gift or trade // purchased
    (c) If purchased, how much did it cost? _____ and where did you buy it (community member or fish buyer)?: _____
58. Are there seasons when your household consumes more or less fish and/or seafood?
    yes // no If yes, when and why? _____

Food Security

59. Household Food Insecurity Access Scale:

In the past four week,	
1. Did you worry that your household would not have enough food?	No Yes, but rarely (1-2 times) Yes, sometimes (3-10 times) Yes, frequently (10+ times)
2. Were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?	No Yes, but rarely (1-2 times) Yes, sometimes (3-10 times) Yes, frequently (10+ times)
3. Did you or any household member have to eat a limited variety of foods due to a lack of resources?	No Yes, but rarely (1-2 times) Yes, sometimes (3-10 times) Yes, frequently (10+ times)
4. Did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?	No Yes, but rarely (1-2 times) Yes, sometimes (3-10 times) Yes, frequently (10+ times)

5. Did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?	No Yes, but rarely (1-2 times) Yes, sometimes (3-10 times) Yes, frequently (10+ times)
6. Did you or any household member have to eat fewer meals in a day because there was not enough food? 7. Was there ever no food to eat of any kind in your household because of lack of resources to get food?	No Yes, but rarely (1-2 times) Yes, sometimes (3-10 times) Yes, frequently (10+ times)
8. Did you or any household member go to sleep at night hungry because there was not enough food?	No Yes, but rarely (1-2 times) Yes, sometimes (3-10 times) Yes, frequently (10+ times)
9. Did you or any household member go a whole day and night without eating anything because there was not enough food?	No Yes, but rarely (1-2 times) Yes, sometimes (3-10 times) Yes, frequently (10+ times)

60. Are there months or seasons when you worried more or less about feeding your family?
    yes // no If yes, when and why? _____

Education

61. How important is social and cultural education for you and your family?
    Not important // a little important // important // pretty important // very important
62. What is the education level of each member of your household?

ID #	Can they read & write	What is the highest grade level they completed?	Have they completed other education? (certificate program, technical training, etc.)
1			
2			
3			
4			
5			
…			

Health

63. In general, would you say your health is: very bad // bad // okay // good // very good
64. How satisfied are you with the available health services?
    very unsatisfied // unsatisfied // satisfied // very satisfied
65. When was the last time you or someone in your household used the following health services?
    (a) Healer, midwife, traditional medicine:
        a week // a month // months // a year // years // never
    (b) Health clinic in Juanchaco:
        a week // a month // months // a year // years // never
    (c) Visiting medical missions:
        a week // a month // months // a year // years // never
    (d) Clinic or hospital in Buenaventura:
        a week // a month // months // a year // years // never
    (e) Clinic or hospital in Cali:
        a week // a month // months // a year // years // never
    (f) Other:
        a week // a month // months // a year // years // never

66. Do you or another member of your household have any form of medical insurance?
    yes // no If yes, what kind? _____ and for who? _____
67. How old were you when you had your first child? _____
68. Have you had any children that have passed away? yes // no
    If yes, how old were they when they died? _____
69. Where did you or your partner give birth to your first and last child? Did a medical professional assist during labor?

First	Location:	home // health clinic // hospital // other
	Professional assistance:	no // midwife // nurse // doctor
Last	Location:	home // health clinic // hospital // other
	Professional assistance:	no // midwife // nurse // doctor

70. How many (live born) children did your mother have? male: _____ female: _____

Household Economic Conditions

71. Who manages the money/income in your household? _____
72. Does anyone in the household have a bank account? yes // no
73. Has anyone in the household ever taken out a loan from a bank or institution? yes // no
    If no, would you know how to take out a loan? yes // no
74. Do you have savings or access to financial resources in the case of an emergency?
    yes // no
75. Over the past 12 months, have you regularly sent money to someone who is not currently living in your household? yes // no
76. Over the past 12 months, have you regularly received money from someone who is not currently living in your household? yes // no
77. How difficult or easy is it manage your daily household needs with your current household income? very difficult // difficult // not a problem // easy // very easy
78. Have you or anyone from your household participated in or benefited directly from a governmental or non-governmental institution or program? yes // no
    If yes, what program and what was the nature of support? _____

Community and Institutions

79. Would you say that this is a community where neighbors help one another?
    Always // Normally // Sometimes // Rarely // Never // Don't Know
80. How much do you trust your neighbors?
    I trust the majority // I trust some // I trust few // I don't trust anyone
81. On average, how many days per week do you share or exchange food with friends, family, or neighbors? _____

82. How satisfied are you with the relationship between the community and:

(a) Community Council	very unsatisfied	unsatisfied	neutral	satisfied	very satisfied
(b) Mayor of Buenaventura	very unsatisfied	unsatisfied	neutral	satisfied	very satisfied
(c) National Park (Uramba)	very unsatisfied	unsatisfied	neutral	satisfied	very satisfied
(d) CVC:	very unsatisfied	unsatisfied	neutral	satisfied	very satisfied

(e) Armed Forces:	very unsatisfied	unsatisfied	neutral	satisfied	very satisfied
(f) National Police:	very unsatisfied	unsatisfied	neutral	satisfied	very satisfied

83. Were you in favor of the creation of Uramba National Park? yes // no // don't know
    If yes, do you agree with the current management of the park? yes // no // don't know
84. What are the most urgent needs for your community, in order of importance?
    (a) work (e) waste management (h) park/field
    (b) education (i) pier
    (c) health (f) sewer system (j) electricity
    (d) electricity (g) church (k) security/police
    Other: _____

Migration

85. Were you born in this community? yes // no Your partner? yes // no

    If yes, How many years have you lived elsewhere? _____ Your partner? _____
    If no, Where were you born? _____ Your partner? _____
    When did you move here? _____ Your partner? _____
    Where did you move from? _____ Your partner? _____
    Why did you move here? _____ Your partner? _____
86. Were you born in this community? yes // no Your partner? yes // no
    If yes, How many years have you lived elsewhere? _____Your partner? _____
    If no, Where were you born? _____ Your partner? _____
    When did you move here? _____ Your partner? _____
    Where did you move from? _____ Your partner? _____
    Why did you move here? _____ Your partner? _____
87. How many times during the past 5 years have you or anyone in your household lived outside of the community (for more than a month)? _____
    What were the reason for living there:
    work // study // medical care // family/friends // other:
88. How many times in the past four weeks have you or someone in your household traveled outside of Bahía Málaga? _____
    What were the reason for leaving: shopping // paperwork or official errands // medical care // social visits // vacation // studies // other: _____
89. Have you ever had to move or relocate due to erosion or flooding of the beach or cliffs? yes // no If yes, in what year? _____ From where? _____
    Did you receive any government support? yes // no
90. Do you think that you will have to move in the future due to erosion or flooding of the beach or cliffs? yes // no If yes, where do you plan to move?
    within the community // to another community // out of the region // unsure or undecided
91. Do you think about moving in the future for other reasons? yes // no
    If yes, where? _____ And why? _____
92. Do you think that more people will move into your community? yes // no
    If yes, from where? other rural areas // cities // foreign countries

D. Fishing Power Calculations

Fishing power categories were determined by the type of vessel and motor used by fishing households. Households that reported multiple methods were categorized into the higher power level. Households reported average monthly catch, which was divided by the number of days they reported fishing per month and used to calculate average daily catch for each level of fishing power (Table 5). The medium low power category was the most common in Bahia Malaga and most similar to traditional artisanal fishing, so it was used as the baseline to calculate catch coefficients.

Table 5: Fishing Power Levels

Power Level	Vessel	Motor	Average Daily Catch	Catch Coefficient
Low	None	None	20 kg	0.6
Medium-Low	Canoe or boat	None	32 kg	1
Medium	Canoe or boat	1-14HP	42 kg	1.3
Medium-High	Boat	15-25 HP	90 kg	2.8
High	Boat	40+ HP	112 kg	3.5

Gear type was not included in fishing power calculations because gear use was similar across communities (Appendix B) and power-levels (Figure 24). Additionally, average catches were reported at the household level and, since many households used more than one gear type, were not useful in determining effect on catch rates. The primary gears were hand lines, long lines, and nets of various lengths and mesh sizes. The only notable exceptions are that those in the lowest power level (fishing from shore) did not use long lines, and higher power levels highest power category had greater gear diversity, most of which was reported by fishers in Juanchaco.

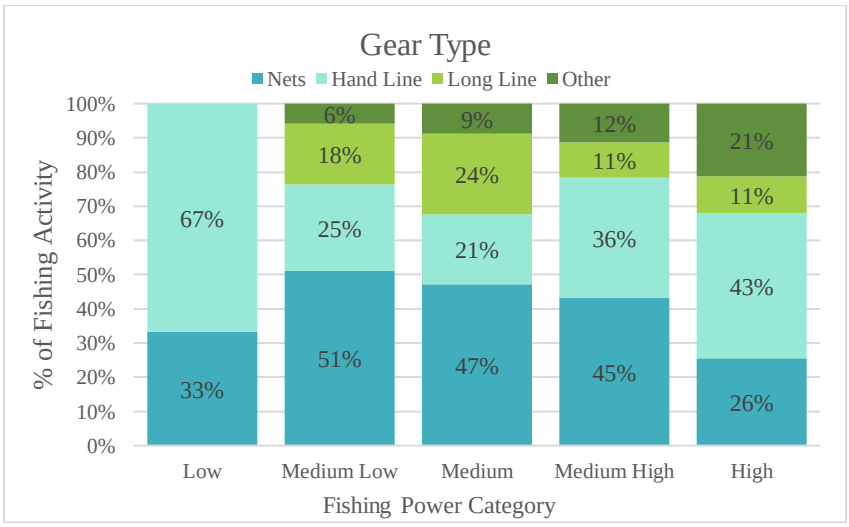
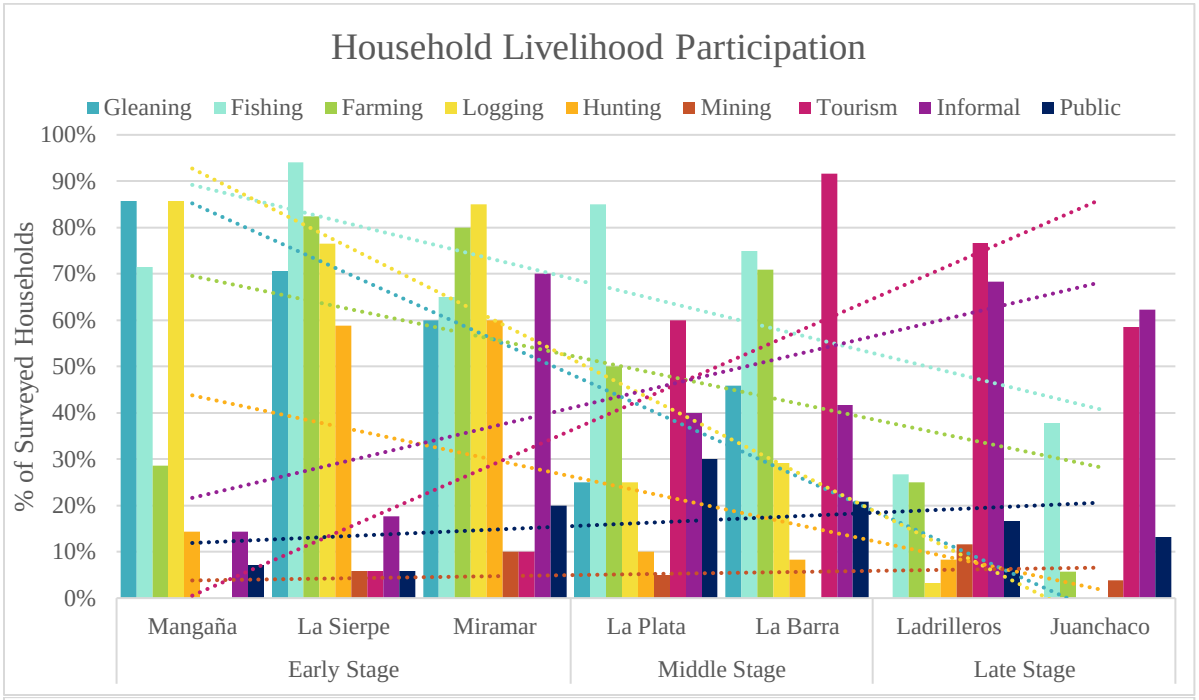
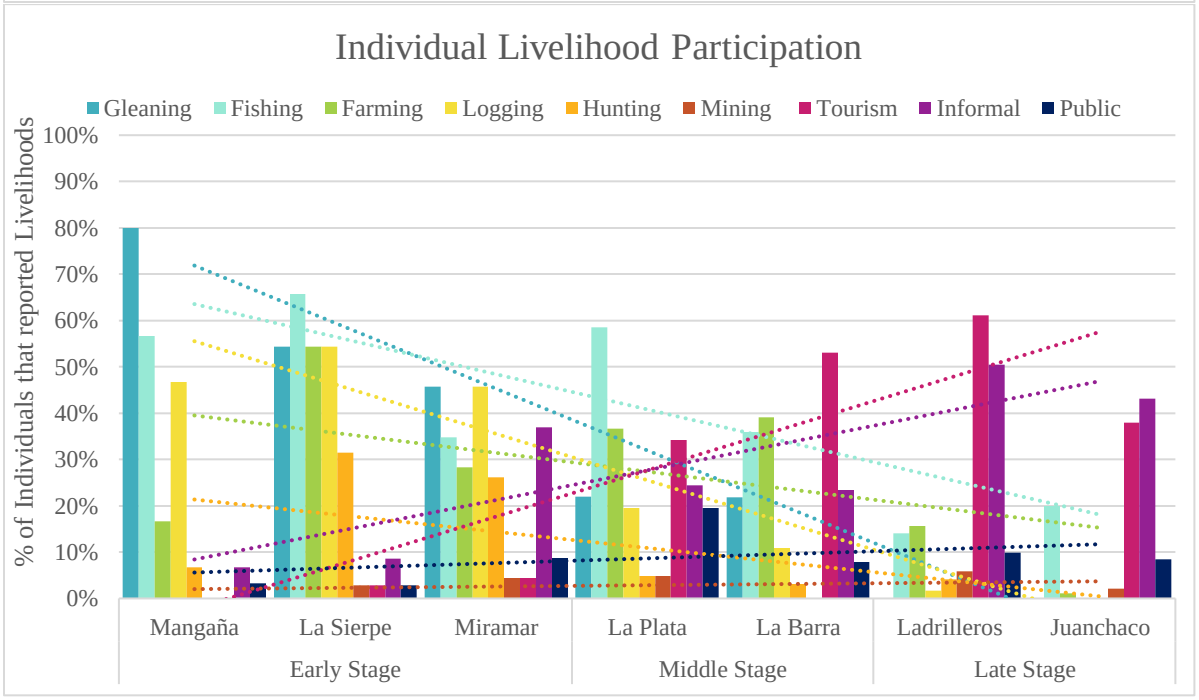


Figure 24: Reported gear use by fishing power level. Most households used multiple gears, so percentages do not correspond to percent of fishing households.

E. Individual and Household Livelihood Participation in all Livelihood Sectors





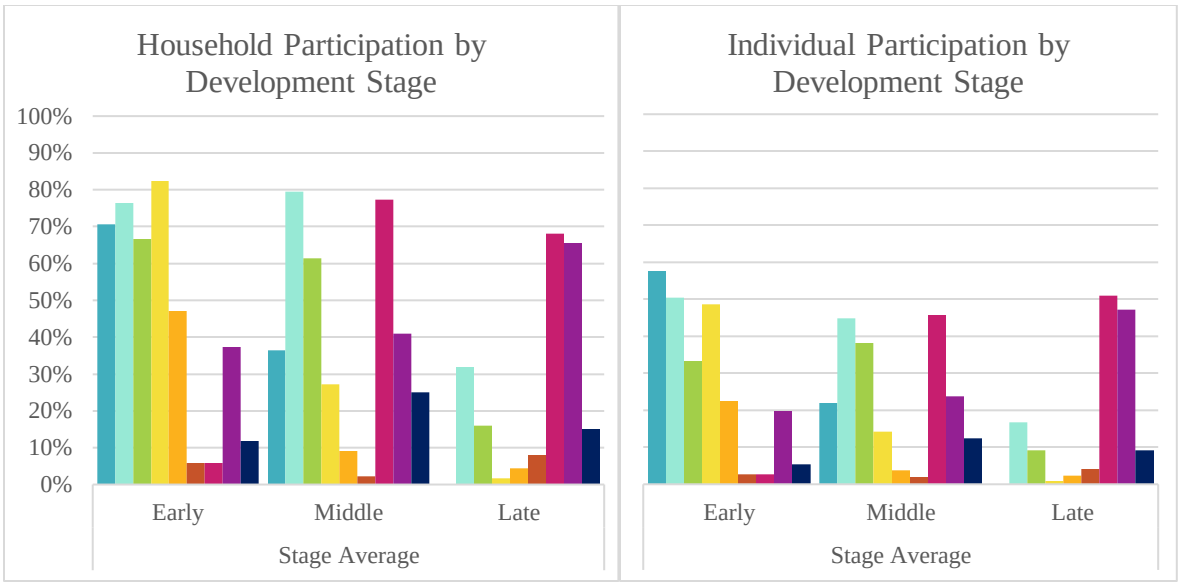


Figure 25: Individual and household participation rates in each livelihood sector

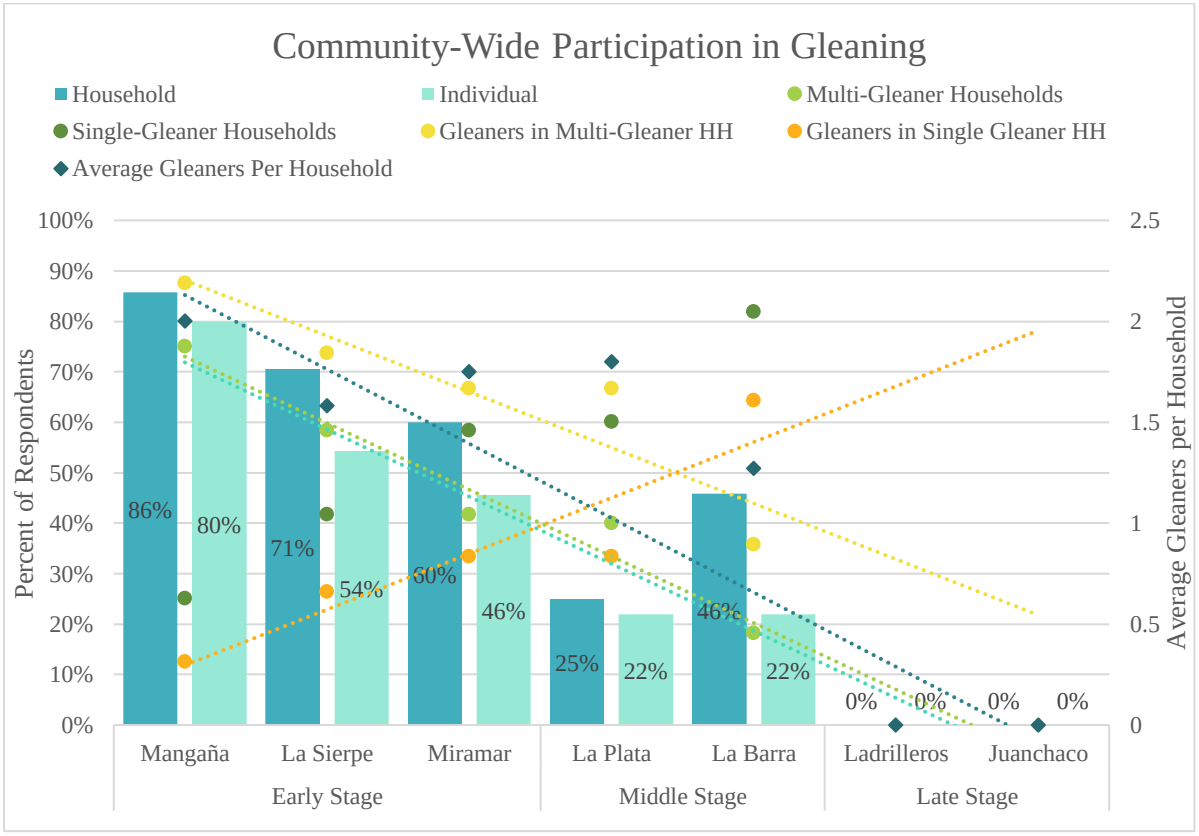


Figure 26: Gleaning participation and distribution of gleaners in single-gleaner or multi-gleaner households

F. Importance of Fishing and Gleaning Livelihoods

Households were asked to rank their top three livelihoods and the bars are proportional to the percentage of gleaning households that ranked it as their first, second, or third most important, with the gray area representing households that gleaned but did not rank it among their top livelihoods.

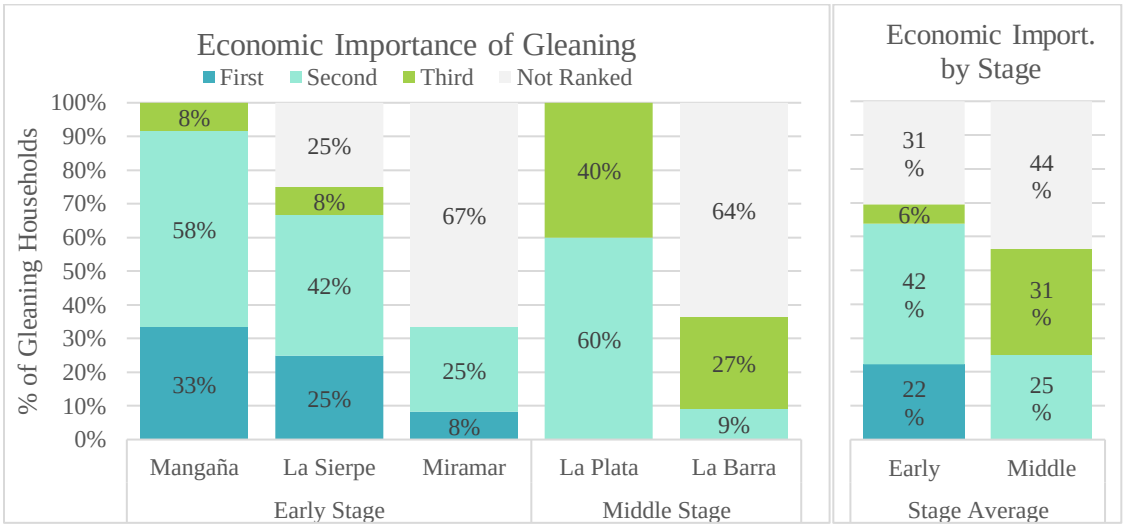


Figure 27: Importance of gleaning livelihoods in terms of economic contribution among households that reported gleaning in the past 12 months.

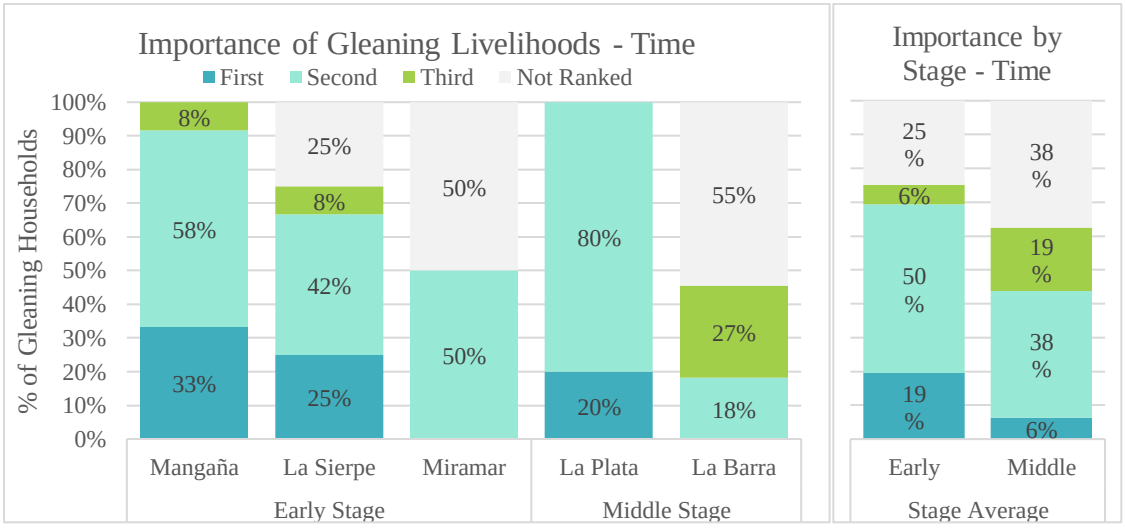


Figure 28: Importance of gleaning livelihoods in terms of time spent among households that reported gleaning in the past 12 months.

G. Distribution of Gleaning Effort

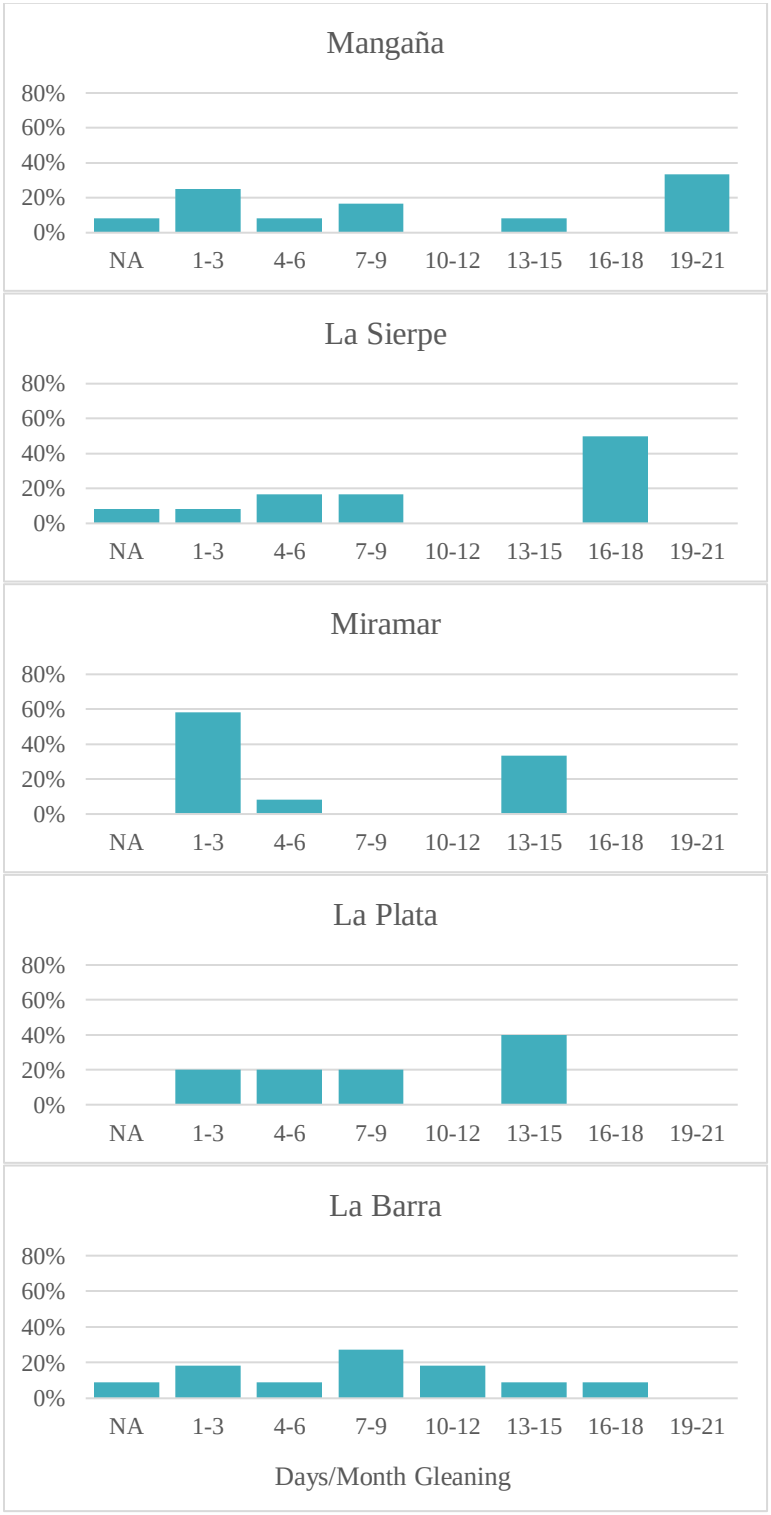


Figure 29: Histogram of household gleaning effort showing only households that reported gleaning

H. Fisher and Gleaner Demographics

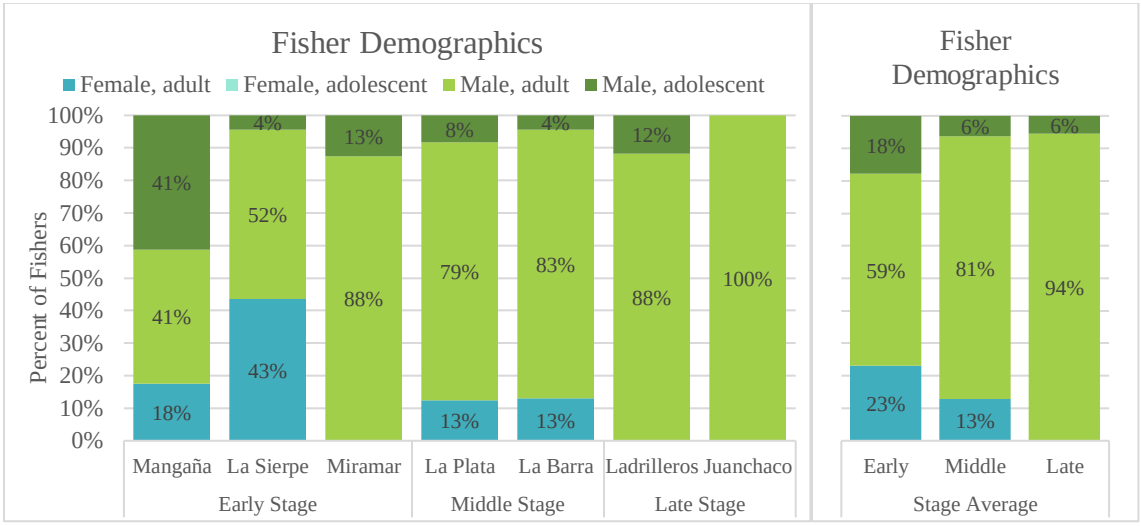


Figure 30: Fisher Demographics — Proportion of fishers in each demographic group based on age and gender, where adult indicates anyone living independently or at least 20 years of age

Women reported fishing in only four of the seven communities, with the highest percentages in the communities with the least tourism development (18% in Mangaña and 43% in La Sierpe), lower participation among women in communities in the middle stage (13% in both La Plata and La Barra), and no female fishers in Miramar or the communities with the most tourism development.

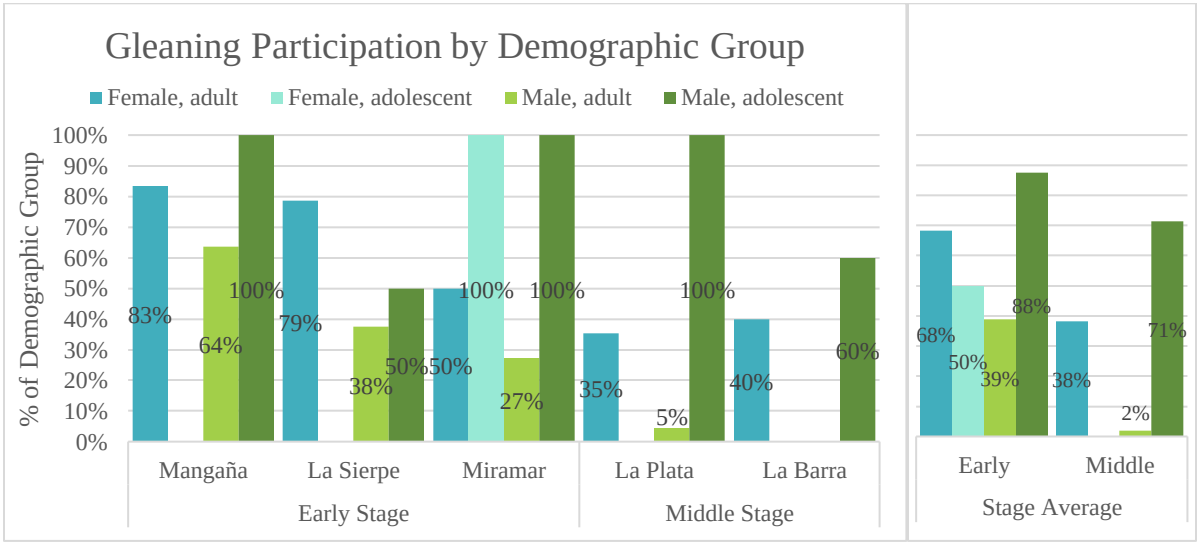


Figure 31: Gleaning Participation within Demographic Groups

I. Consumption and Sale of Fishery Catches

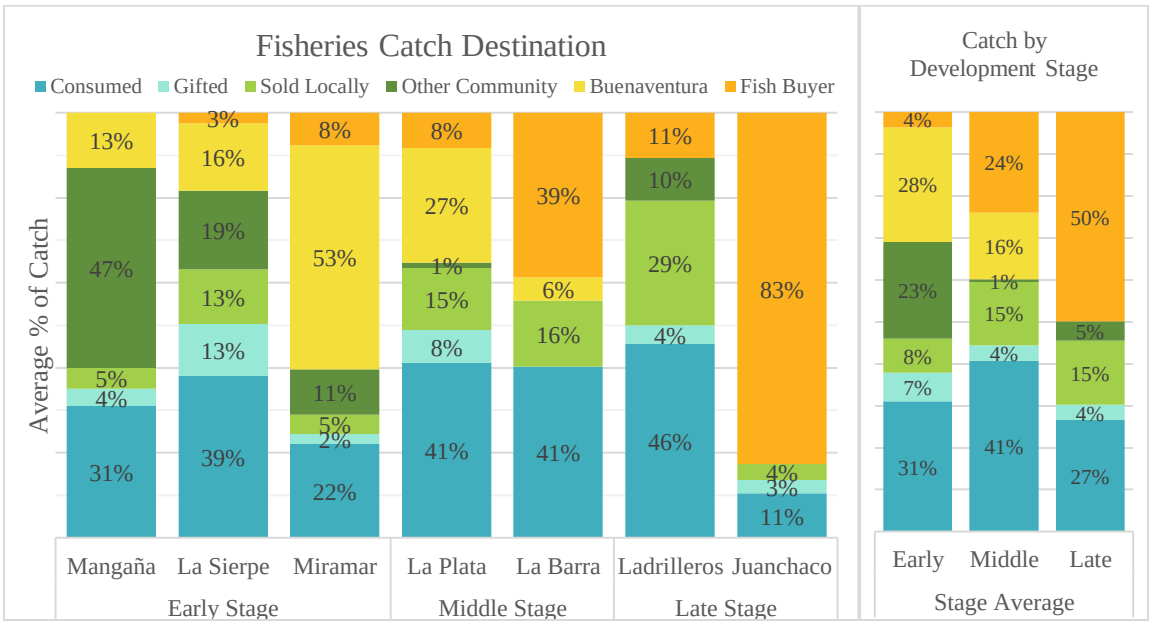


Figure 32: Consumption and Sale of Fishery Catches