Spatial Patterns in Guyana’s Wild Bird Trade

by

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Spatial Patterns in Guyana's Wild Bird Trade

APPROVED BY

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Rodrigo Sierra

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Dedication

To Victor Emanuel, who introduced me to parrots in the wild

Acknowledgements

This thesis has been a journey, and there are many people that have helped along the way. First, I would like to express my appreciation to my advisor, Dr Rodrigo Sierra. He helped me refine my ideas in the very beginning, and stuck with me until the very end. Similarly, my reader, Dr. Kenneth Young, provided valuable guidance in times of need. I want to thank Anne Dibble for being one of the kindest and most helpful people I have ever met. In addition, Brian O'Shea and Stephen Hanks read my thesis and provided valuable feedback. Brian O'Shea also deserves credit for introducing me to Guyana. It was during an expedition in 2001 with Brian that I first thought of studying the wild bird trade.

While in Guyana I was almost always aided by the help of local Guyanese, I'm sorry that I cannot name them all here. In particular, there are a few people that provided support throughout my entire time in Guyana. My good friend Wiltshire Hinds joined me during much of the fieldwork, and provided valuable feedback on my research. Malcolm and Margaret Chan-A-Sue provided valuable logistical guidance, and a most hospitable refuge in Georgetown. The Defreitas family graciously took me in despite showing up randomly on their doorstep in the middle of a rainstorm. I very much look forward to the next time I can experience Dandanawa. Finally, I want to express my deep appreciation to all of the exporters, traders, and trappers who generously allowed me to question them about the wild bird trade.

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Abstract

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Governments and international organizations have attempted to develop preemptive regulatory regimes that prevent overexploitation in the wild bird trade. Most trade regulation focuses on international borders, but managing sub-national trade is one of the greatest challenges in wild bird trade regulation. Sub-national regulation will greatly benefit from a better understanding of how the trade works and what influences it. This thesis examines the structure and spatial pattern of the wild bird trade within Guyana in an attempt to offer insight into how different factors impact patterns in harvesting pressure. Based on market value, it analyzes how selective the harvest becomes as the distance from regional markets and the capital increases. In addition, it examines the associated cost of transportation for both the trapper and the trader.

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Chapter 1: Why Study Spatial Patterns in Guyana's Wild Bird Trade

Wild birds make popular pets. Colorful plumages, melodious songs, gregarious personalities and other characteristics can turn wild birds into valuable commodities which are traded over long distances. Such trade is found throughout history. Well before Christopher Columbus stumbled upon the New World, Scarlet Macaws caught in Mesoamerica were traded and bred as far north as present day Arizona and New Mexico (Minnis et al. 1993; Borson et al. 1998; Creel and Mccusick 1994). Columbus himself brought back a parrot from his first voyage to the New World, initiating a transatlantic bird trade which continues today. Until relatively recently the live wild bird trade was moderated by difficulties in transportation. However, as road and other transportation networks improved, wild populations have become more accessible to urban markets. In addition, the advent of the commercial airline industry in the mid 1900s enabled exporters to ship live birds to distant markets around the world. By the mid 1900s, the demand for wild caught birds, and the efficiency of their trade, was greater than ever before (Mulliken, Broad, and Thomsen 1991; Thomsen and Brautigam 1991). As a result, many wild populations have been overexploited, and some species are now endangered or extinct in the wild. Two notable examples include the Red Siskin (*Carduelis cucullata*) in Venezuela (Coats 1985), and the Blue-throated Macaw (*Ara glaucogularis*) in Bolivia (Hesse and Duffield 2000). Cases such as these have highlighted the need for regulation that can protect populations in the wild.

In response, governments and international organizations have attempted to develop preemptive regulatory regimes that prevent overexploitation. Most trade regulation focuses on international borders, but managing local and sub-national trade is one of the greatest challenges facing wild bird trade regulation. Policy debates on the wild bird trade focus primarily on the difference between trade bans, like the Wild Bird Conservation Act, and national quotas, the tool of choice in CITES Appendix II regulation (see Appendix A). However, there are cases when both are insufficient for preventing overexploitation. In some cases the domestic trade is a much greater threat to native species (e.g. for parrots, Gonzalez, 2003; for songbirds, Ribon et al. 2003). Also, many international borders have a weak law enforcement presence and are not a barrier to illegal trade. Even when the national quota is obeyed, it does not control or even document where in the country these birds are harvested. If regulation focuses on the international border, some local population can be extirpated while others remain untouched. In all of these cases, monitoring and influencing the trade will benefit from a better understanding of how the trade works and what influences it.

In most cases, no single source of information will be sufficient for monitoring the trade. Market surveys documenting quantities and prices at end markets offer valuable data that can be relatively easy to collect. However, trends in end market data reflect many factors. These include changes in demand, changes in the perceptions of people involved in the trade, as well as population declines due to overexploitation or habitat loss. Spatially explicit research on the trade can help disentangle these influences and assist in interpreting end market data (Milner-Gulland and Clayton 2002). This is essential for predicting how harvesting pressure will change in response to a change in market value for a particular species.

Within this context, this thesis examines the structure and spatial pattern of the wild bird trade within Guyana in an attempt to offer insight into how different factors impact patterns in harvesting pressure. Guyana is an opportune place to study the spatial patterns in harvesting pressure for many reasons. First, the trade in Guyana is legal and conducted in public. Unlike when the trade is illegal, it is possible to directly observe transactions in the bird trade, and it is much easier to interview participants in the trade. Second, the trade involves many different species with different market values. This allows for a comparative evaluation of the influence of market value. This is useful for studying how harvesting pressure will change as market value changes. In addition, it is useful for studying the relationship between the harvest regimes of high and low value species. Third, the demand for birds is concentrated in the capital where the main markets and exporters are located. Compared to a trade with multiple urban markets, it is easier to document the spatial relationship between the source and the market. Fourth, the interior of Guyana has a limited transportation infrastructure and a high cost of transportation in the interior. As a result, the impact of the cost of transportation on the trade is magnified, making it easier to document. In addition, it is comparable to other remote regions that have a wild bird trade but are difficult to monitor. Fifth, Guyana has an extensive trade in wild birds which supplies both domestic and international markets, and it exemplifies many of the limitations of CITES Appendix II regulation. Research on this system will be a useful case study that could offer insight into research and regulation on the wild bird trade in other countries that face similar challenges.

In Guyana, the international trade is mainly in parrots and toucans, and their regulation is driven by the CITES Appendix II framework. Although Guyana is one of the most important exporters of Appendix II species in the world, the domestic segment of the trade in these species is not monitored. As a result, there is minimal information available on where these birds are harvested within the country. In addition, there is a domestic trade in species that are not legally exported. This trade is primarily in finches in the genera *Oryzoborus* and *Sporophila*. Although this trade is obvious throughout the country, there is even less information available than on the international trade. In either case, understanding the spatial pattern in harvesting pressure would be useful for preemptive detection and prevention of overexploitation.

This study examines both the spatial flow of the bird trade in Guyana and the behavior of actors in the corresponding commodity chain. Understanding the relationship between the actions of trappers and traders and the spatial flow of the bird trade in Guyana is critical for understanding the relationship between market value and spatial patterns in harvesting pressure.

This analysis provides previously unpublished information on processes and spatial patterns in Guyana's wild bird trade. Although it does not make definitive conclusions on the sustainability of the trade, it does make suggestions on how the trade could be monitored to help achieve conservation goals in Guyana. It is also useful outside Guyana because it offers insight into the relationship between market value and spatial patterns in harvesting pressure in the wild bird trade. The next chapter reviews research on other types of commercial trade in wild species in order to provide a theoretical context to the central question addressed by this thesis. Subsequent chapters will demonstrate how this body of research can be applied to the wild bird trade.

Chapter 2: Research on Spatial Patterns in Harvesting Pressure

Although spatial patterns in harvesting pressure have not been studied in the wild bird trade, studies on the harvest of other wild species provide a framework for where to start. Additionally, spatially explicit theories, such as Von Thunen's location model, also offer insight into how distance from market, commodity price, and the cost of transporting that commodity will influence how the land will be used. In part 2.1, this chapter will review von Thunen's location theory, and how the cost of transportation has been used to model patterns in harvesting pressure on timber in the Amazon basin. In part 2.2, this chapter reviews case studies in the wildlife trade to demonstrate how a similar pattern has been observed in wildlife harvesting. In addition, it will review how labor supply can influence harvesting intensity, and why it should be considered another spatial variable.

2.1 Von Thunen's Theory

Von Thunen developed location theory to model crop choice at different distances from market. Von Thunen, a German economist born in 1783, published his theory in a book in 1826 which was titled "Der isolierte Staat", which means "The Isolated State" (For an English translation: Thunen, 1966). Von Thunen's theory offers insight into how distance from market, commodity price, and the cost of transporting that commodity will influence how the land will be used. According to his theory, the farther from market you get, the more selective you have to become in how you can use your land.

Stone (1998) applied von Thunen's theory to timber extraction patterns in the Amazon. This makes sense because timber has a high cost of transportation and a large variance in price. Below are two figures from Stone (1998) which explain location theory in regard to timber extraction.

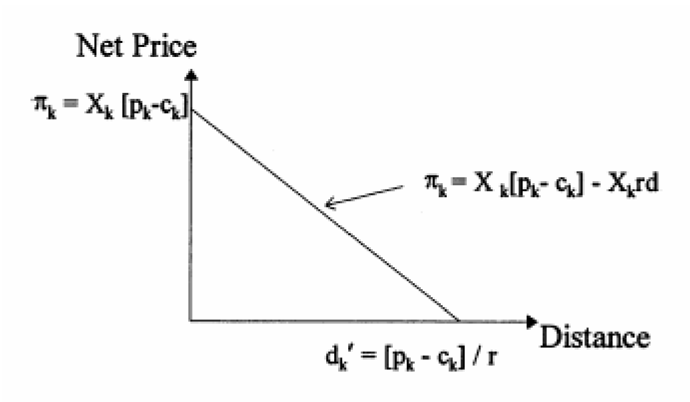

Figure 2.1: The decay of net price over space (from Stone, 1998). k = price class of timber; π_k = net price; X_k = volume of harvestable timber; p_k = price of timber at market; c_k = extraction costs; r = transportation cost; d=distance.

Figure 2.1 illustrates the impact of distance on the net price (π_k), or incentive, for extracting a particular price class of timber (p_k) at different distances from market. The important point is that as the distance from market increases, so does the cost of harvesting a particular volume of timber ($X_k rd$). As a result, to remain profitable as distance increases, timber extraction must become more selective and focus only on higher price classes (see Figure 2.2). At the greatest distance the only timber extracted is the highest value class, in this case its Mahogany. In theory, there is even a limit to the distance at which Mahogany can be profitably extracted. Of course this is a very simplified model because space is not uniform. In particular, the cost of transportation (r) varies greatly depending on the terrain and transportation infrastructure. In addition, the volume of harvestable timber in a particular value class (X_k) also varies greatly over space. Stone (1998) incorporated the variability in both of these parameters into a model of spatial patterns in timber harvest.

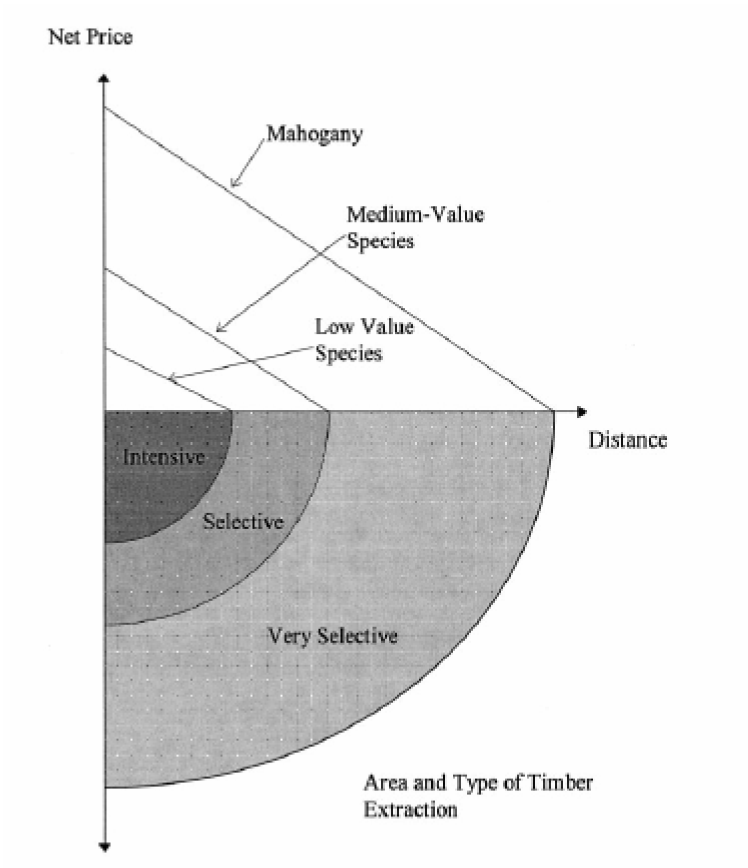

Figure 2.2: How location rents affect timber extraction (From Stone 1998)

Von Thunen's location theory can potentially be used to explain patterns in harvesting pressure in the wild bird trade. Accordingly, it would be expected that as the cost of transportation to market increases, the harvest regime will become more selective and increasingly focus on species that are higher value or less expensive to transport. Although there are no studies on the wild bird trade that suggest that harvesting pressure can be explained by this model, there are studies on other types of wildlife harvesting, particularly the wild meat trade, that are consistent with it.

2.2 Spatial Patterns in Wildlife Harvesting

The trade in wild birds is similar in many ways to the commercial trade in other wild species, especially the wild meat trade. It occurs at local, regional, and international scales. Markets and regulation are concentrated in urban areas, while harvesting occurs in remote areas which are often difficult to monitor, much less to regulate. Most importantly, they share a similar pattern in their commodity chain. As in Guyana's trade, wildlife are often harvested by many harvesters, and then transported or otherwise traded by a relatively smaller number of middlemen. For example, the majority of the wild meat sold in Takoradi, Gana, is harvested by 125 hunters, traded by only 30 middlemen, and sold to customers by 143 "chopbar" operators (Cowlishaw et al. 2004). In international trades this pattern is more exaggerated. Edwards (1993) found that in Nepal, the medicinal plants harvested by 5,800 collectors were funneled through just 3 wholesalers before being sold in India. According to Edwards and Nash (1992), the parrot trade from Irian Jaya included hundreds of trappers, about 30 traders, 15 exporters, and less than six US importers.

In case studies on the wild meat trade, the spatial pattern in harvesting pressure is consistent with von Thunen's model at both the local and regional scale. At a local scale harvesting tends to be concentrated near villages and along transportation routes. For example, in a study on hunters in three lowland Amazonian communities by Begazo and Bodmer (1998), people tended to hunt within 5-7 km of the village, or on longer trips where they traveled by rivers. This study focused on birds in the family Cracidae, and found that populations were greatly reduced in the heavily hunted areas compared to surrounding lightly hunted areas. Another study by Peres and Lake (2003) documented vertebrate abundance at 30 different locations in the Brazilian Amazon. This study demonstrated that large bodied species that are heavily targeted by hunters decrease in density within 5 km of transportation networks. Physical access can provide protection to more remote populations, but as accessible populations are depleted people will harvest more intensely in remote areas (e.g., Bennet et al. 2000; Fa, 2000; Claggett, 1998).

At a regional scale populations that are most accessible to commercial markets tend to have the greatest harvesting intensity, and are the first to be depleted. In addition, improved transportation routes, especially new roads, have been shown to increase harvesting intensity by making it economical for the harvester to get the wildlife to market (e.g., Bennet et al. 2000; Wilkie 2000; Milner-Gulland and Clayton 2002; Milner-Gulland et al. 2003; Sierra et al. 1999).

Market value can be an important mitigating factor in the spatial pattern in harvesting. At both small and large geographic scales, harvesters become more selective the farther they have to travel. For example, in a study of three communities in the Peruvian Amazon, Claggett (1998) found that as larger animals were depleted around communities, subsistence hunters would target smaller species or focus on other activities. Those hunters who did travel long distances to remote areas where game was still plentiful hunted for market and focused on high value species. In Para, Brazil, Silveira and Thorbjarnarson (1999) found that hunters along the rivers were hunting both low value black caiman (*Melanosuchas niger*) and high value pirarucu (*Arapaima gigas*). However, when the hunters traveled into the remote forest interior lakes and lagoons they would focus exclusively on the high value pirarucu. In both of these cases not only do accessibility and market value influence how far the harvester will go, they also influence how selective they are. These studies document a pattern in harvesting pressure that is similar to von Thunen's model of land use.

In addition to explaining current patterns in harvesting pressure, von Thunen's model can be developed into a dynamic model of wildlife overexploitation over time, a kind of overexploitation frontier scenario. With an overexploitation frontier, harvesting of a species that is of low value will be concentrated in the most accessible areas. If these populations are depleted, the cost of producing the wildlife will rise. If the market responds by increasing in value, more inaccessible populations will become profitable to the harvesting regime. How far out the frontier will extend will depend on the dynamics that influence market price, harvesting intensity, and the biology of the species. O'Brien et al. (2003) suggests that this is the case in Madagascar where there is a commercial trade in tortoise meat for urban markets. Near urban centers tortoises have been almost wiped out with abundance increasing significantly with distance from the cities. As a result, commercial harvesters have to travel increasingly far to find sufficient populations. Another example of an overexploitation frontier that is well documented is with Babirusas in North Sulawesi, Indonesia (Milner-Gulland and Clayton 2002).

Von Thunen's model emphasizes the cost of transportation, but it is not the only spatial variable that can influence the overall cost of production. A second variable that may be important in the wildlife trade, especially at smaller scales, is the variability in labor supply. Studies show that the value of labor does influence harvesting intensity. However, this author is not aware of any studies on wildlife harvesting pressure that incorporate the spatial variability in labor supply.

In some cases, such as the wild meat trade, an increase in the value of labor can be associated with an increase in consumption (Milner-Gulland et al, 2002). However, the general pattern is that unemployment, or a decrease in the value of labor will increase the intensity of harvesting pressure. In West Africa, for example, hunting for the wild meat trade will increase when there is a decrease in fish supply. In this case the wild meat trade intensifies due to an increased demand for both income and for food (Brashares et al, 2004). In Venezuela there was a sharp increase in the use of natural resources, including wildlife, associated with the economic crisis that started in 1983 (Rodriguez 2000). Economic crisis can also increase harvesting for the wildlife trade at a local scale. For example, in parts of the northeastern Peruvian Amazon, the commercial parrot trade began when exceptional flooding put local fishermen temporarily out of business (Gonzalez 2003).

The value of labor was incorporated into a bioeconomic model of the wild meat trade in North Sulawesi, Indonesia (Clayton et al. 1997, Milner Gulland and Clayton 2002). This study shows that there could be a spatial connection between harvesting pressure and the value of labor because when the cost of labor increases, so does the cost of transportation. However, this does not incorporate the spatial variability in labor, just the cost of labor. Never the less, it is significant because it demonstrates how high the cost of labor is compared to other types of costs. Compared to agriculture or timber harvesting, hunting or trapping wildlife is much more labor intensive relative to the industrial costs associated with harvest and transportation. As a result, the overall cost of production is more likely to be sensitive to spatial variability in labor supply.

The spatial variability in labor supply can change the overall cost of production in two ways. First, if the value of labor increases, this will increase both the cost of harvest and transportation. Second, regardless of the value of labor, if there is not enough labor in an area, it could be a limiting factor on the volume of the trade.

Chapter 3: Case Study: The Republic of Guyana’s Wild Bird Trade

This chapter provides a background on Guyana’s wild bird trade and the spatial context in which it takes place. It is divided into three parts. Part 3.1 reviews what is known about Guyana’s wild bird trade. Part 3.2 describes how the human population and transportation networks are distributed in Guyana. Finally, part 3.3 describes the distribution of vegetation zones and birds within Guyana. The combined goal of parts 3.2 and 3.3 is to provide insight into three different questions: 1) Where are the potential sources of birds in Guyana? 2) Where are the primary markets in Guyana? And 3) What are the transportation options for connecting the potential sources to the primary markets?

3.1 Guyana’s Commercial Trade in Wild Birds

There is little published on the commercial trade in wild birds in Guyana, and almost everything that has been published is related to the international trade. As a result, there is some information available on the export-oriented trade, but almost nothing available on the trade in birds that are not exported from Guyana.

The global international trade in birds peaked during the ’70s (Thomsen, et al. 1991; Beissinger, 2001), when there was large global demand and little international regulation. However, there are no records documenting how large Guyana’s wild bird trade was up until 1978, the year after Guyana joined CITES. It is possible that Guyana’s trade did not really gear up until the 1970s; a 1968 report on wildlife and conservation in

Guyana reviewed threats to wildlife, but did not even mention the wildlife trade (Hanif and Poonai, 1968).

Since 1978 Guyana has been one of the most important exporters of birds in Latin America, especially for Macaws (Genus *Ara*). According to the CITES database available online at www.cites.org, between 1990 and 2002 Guyana exported 23,648 Macaws. This is despite the fact that the trade was shut down temporarily on three occasions during this time period. This is almost twice as many Macaws as their greatest competitor, Suriname. Excluding Suriname, Guyana exported more macaws than all other countries combined. In total, Guyana exported over 175,000 Parrots between 1990 and 2002.

The structure of the commodity chain is a three-tiered system consisting of a trapper, a trader, and an exporter (Edwards 1992). According to the head of the Guyana Wildlife Exporters Association, there were 7540 domestic traders and trappers in Guyana that supplied 16 exporters in 1991 (Edwards 1992). The number of exporters that are officially licensed by Guyana's Wildlife Division has increased since 1991, but according to Bal Parsaud, the previous head of Guyana's Wildlife Division, the majority of the trade is actually controlled by only six or seven exporters (Richards, 2000).

According to Edwards (1992), exporters claim that the majority of birds come from only 10% of the country, but there is no evidence to confirm this estimate. Some have claimed that the illegal trade with neighboring countries plays an important role in Guyana's trade. Desenne (1991) observed parrots being imported into Guyana's northeast district from Venezuela. Furthermore, Kratter (1998) and Duplaix (2001) reported that large numbers of birds are exported illegally to Suriname every year.

Guyana has a trade in songbirds that is quite apparent on the streets of Georgetown, but almost invisible in the literature. Duplaix (2001) does report that *Oryzoborus crassirostris* and *Oryzoborus angolensis* are both smuggled into Suriname from Guyana. This genus is noteworthy because the species in this genus are highly sought-after because of their singing ability in Suriname, Venezuela, and Brazil. As a result, they have been extirpated from parts of both Venezuela and Brazil, and possibly Suriname as well (Duplaix, 2001; Hilty and de Schauensee, 2003; Machado, 1998; Ribon et al. 2003). This thesis will be the first publication that provides insight into the trade in these species within Guyana.

3.2 Spatial Patterns in Guyana's Human Population and Transportation Networks

Guyana has a small population and limited transportation infrastructure. Its total area is over 214,000 square kilometers, but its population is less than 800,000. Guyana's average population density is less than 4 people per square kilometer, and in the Americas only Suriname and French Guiana have lower population densities. More importantly, Guyana's population is overwhelmingly concentrated in the Capital and along the East Coast.

The primary markets in Guyana are in Georgetown, and to a lesser extent, along the East Coast. Georgetown is where exporters live, buy birds, quarantine birds before export, and then export birds. This is also primarily where the consumers live for the domestic bird trade. This is illustrated by Figure 3.1, which shows how population density varies in Guyana, Figure 3.2, which shows the distribution of permanent settlements in Guyana, and Figure 3.3, which illustrates in red the areas that have been degraded or cultivated.

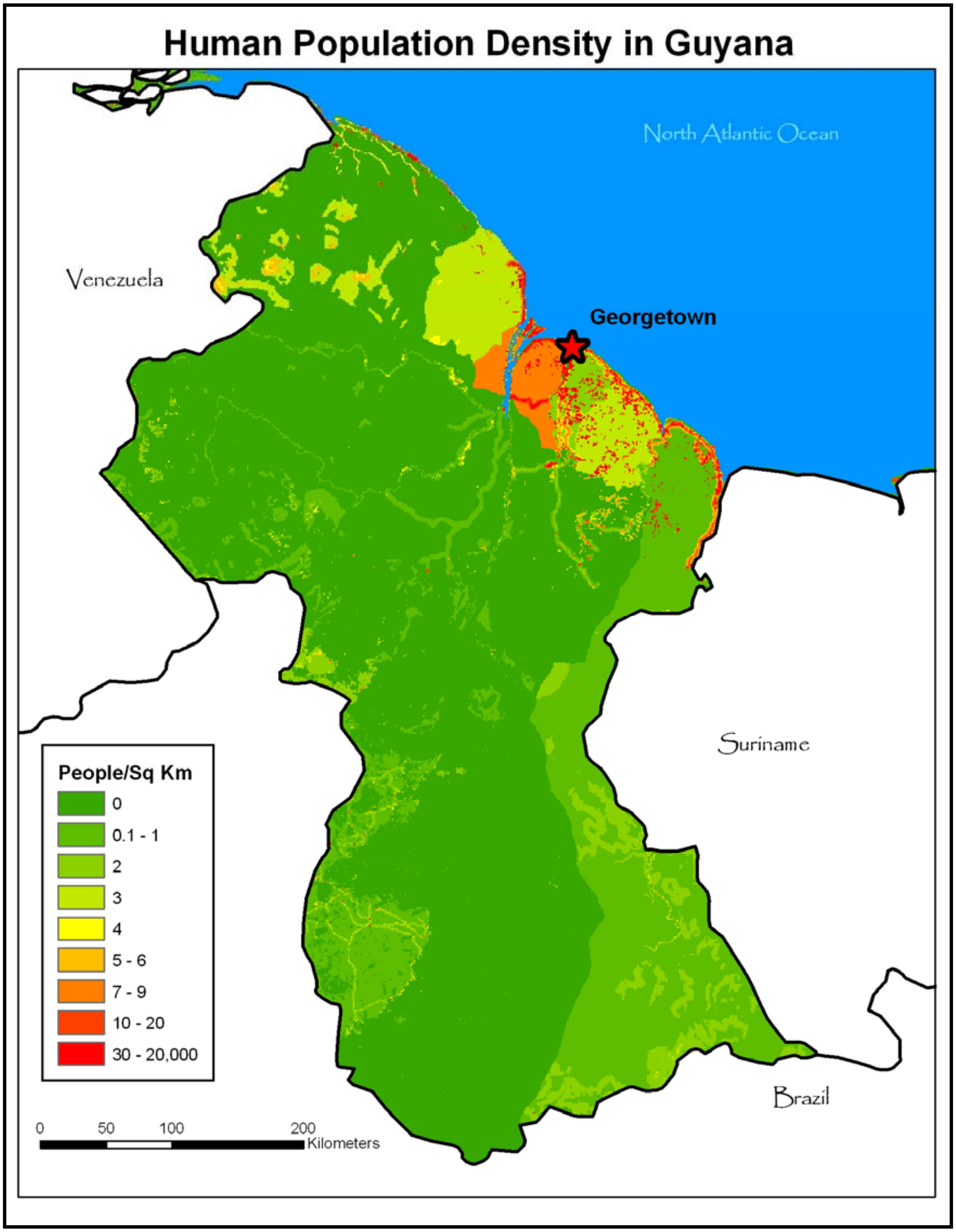

Figure 3.1: Map of human population density in Guyana based on Landscan (2002) data. Guyana's population is highly concentrated along the East Coast of Guyana.

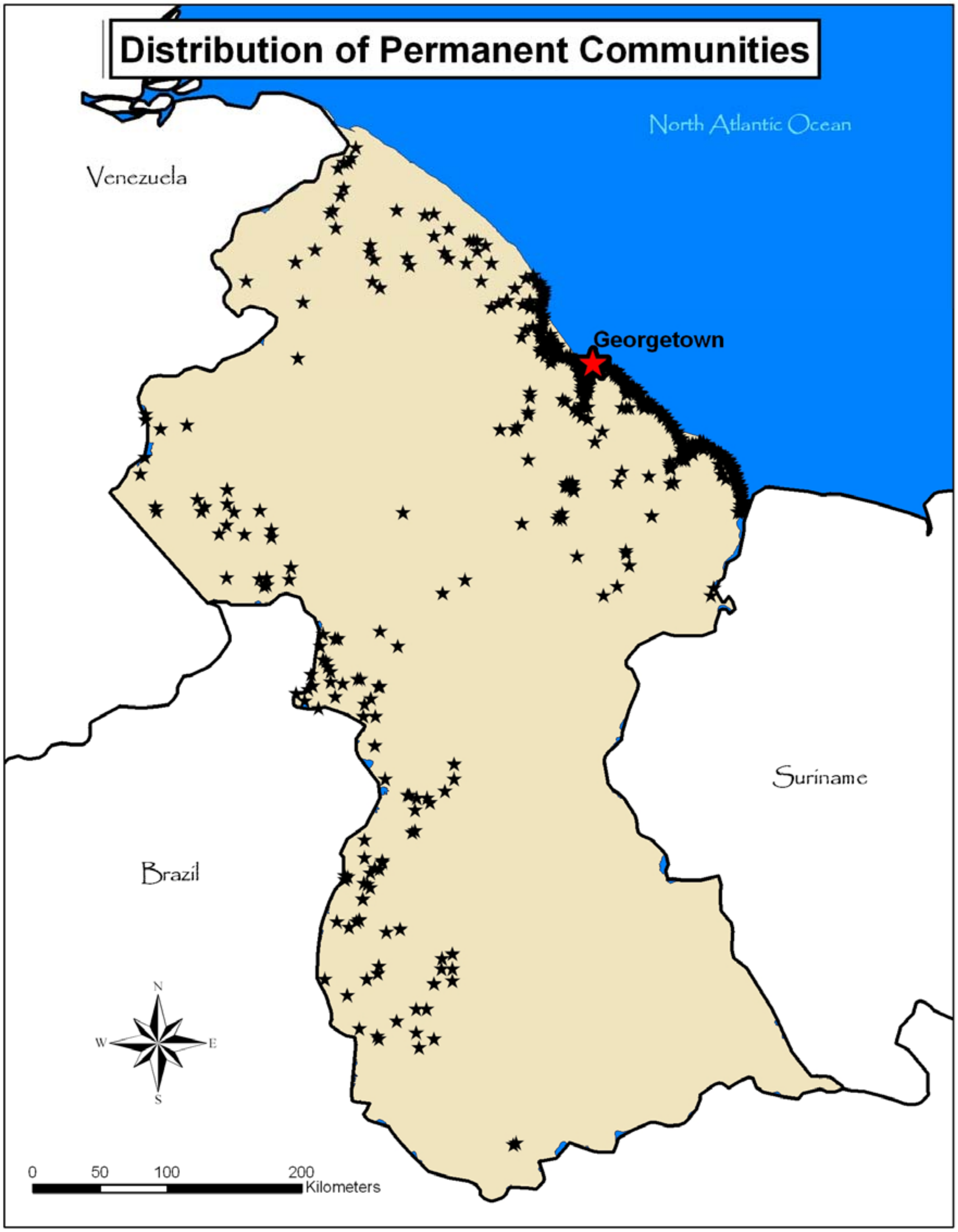

Figure 3.2: Map of the permanently inhabited settlements in Guyana.

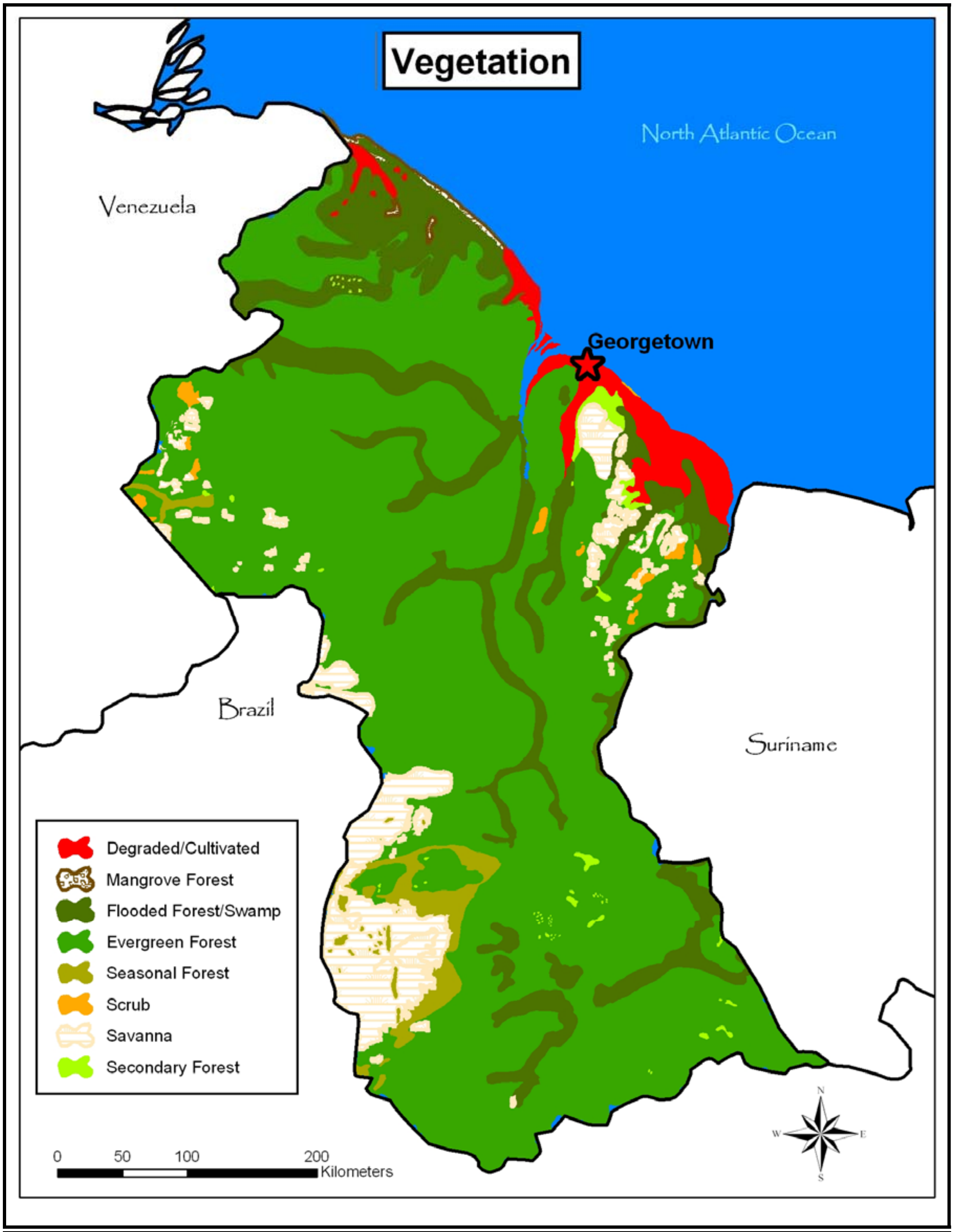

Figure 3.3: Map of vegetation zones in Guyana (Huber et al. 1995)

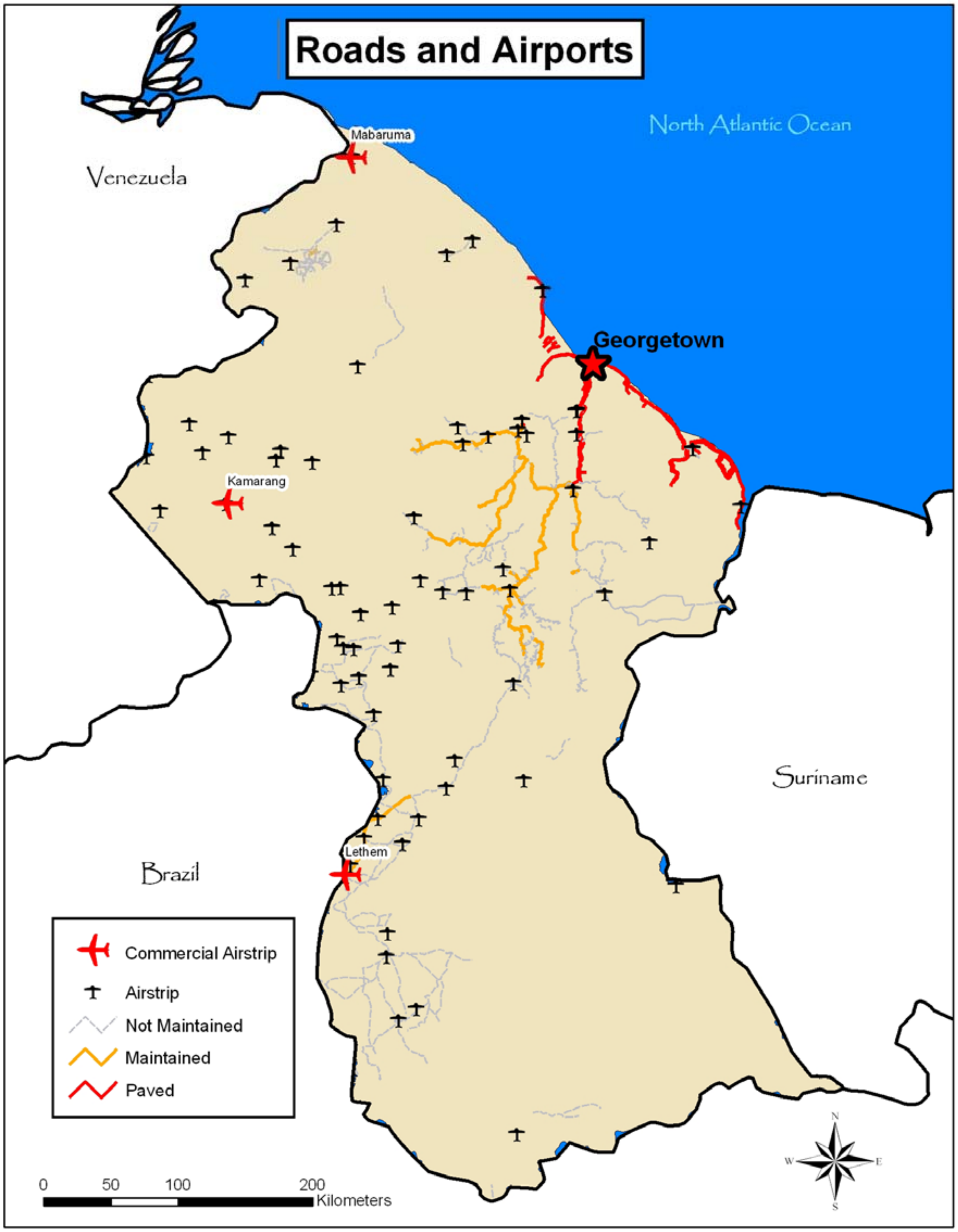

Figure 3.4: Map of roads and Airports in Guyana. The airstrips in Red have regular commercial service.

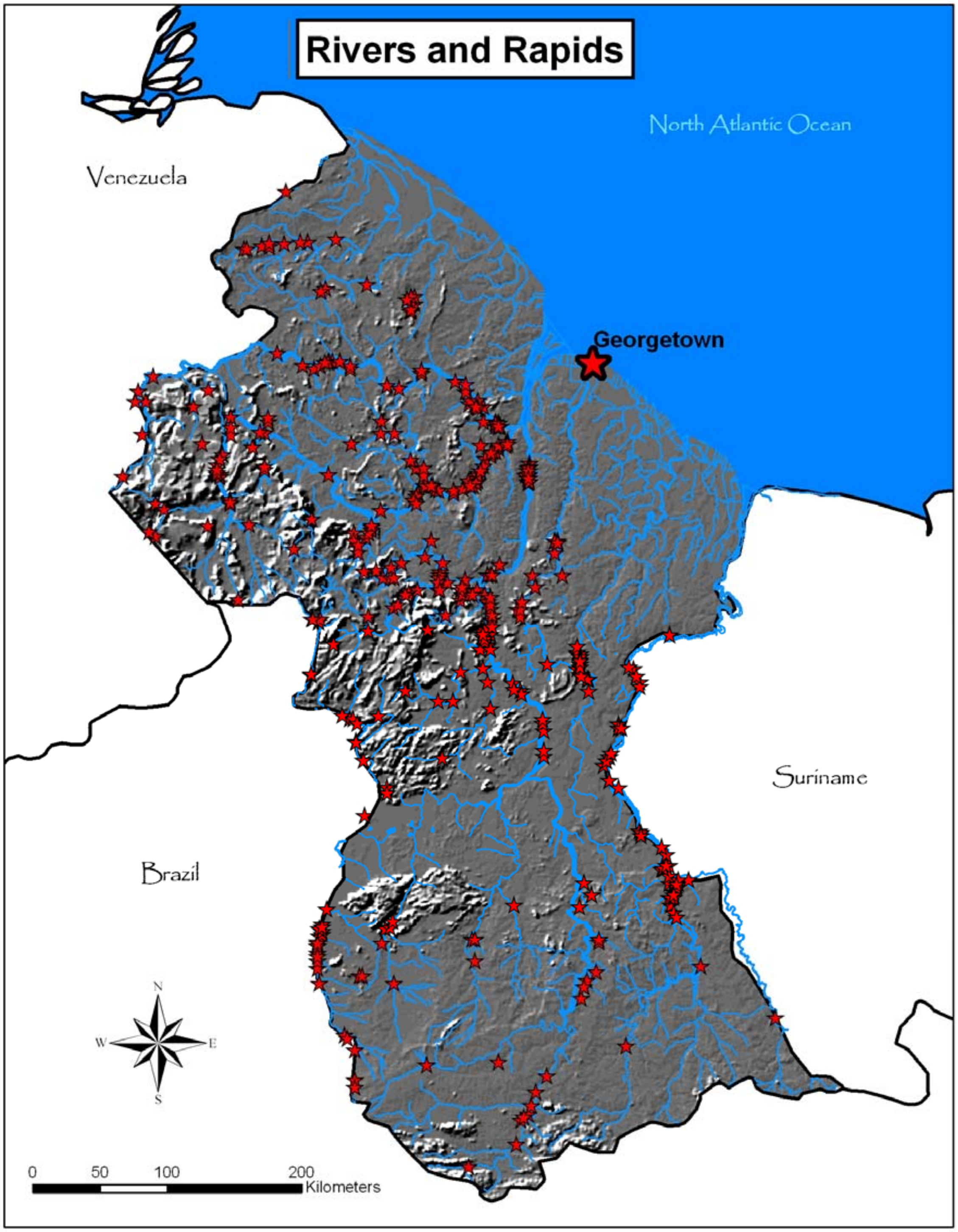

Figure 3.5: Map of rivers, rapids, and topography in Guyana. The small red stars are rapids or waterfalls. Rivers are important for transportation, but it is much more difficult where there are rapids.

The variability of the human population density in the interior is important because of the potential impact on labor supply in the wild bird trade. In the interior, the permanent settlements are primarily located in the Northwest, along the rivers on the east coast, and along the western border. As illustrated in Figure 3.2, there are few permanent settlements in the central and southeastern parts of the country.

There are three primary modes of transportation in Guyana: automobile, airplane, and boat. Similar to the pattern in populated areas, the transportation network is most developed along the coast and limited or nonexistent in the interior. Figure 3.4 illustrates the distribution of roads and airports in Guyana. The only paved roads in Guyana are restricted to the east coast. In the interior, the road network consists of either maintained dirt roads or dirt tracks. Often the dirt tracks are only accessible to four wheel drive vehicles, especially in the wet season.

As shown in Figure 3.4, there are airstrips throughout the interior. Most of these airstrips were built to support the mining industry, and in the most inaccessible areas small planes become the principal means of transportation for both goods and people. However, most of the airstrips do not have regular commercial service. There are three basic commercial routes in Guyana's interior. They go from Georgetown to Kamarang, Mabaruma, and Lethem. These routes will often include stops at Annai, Imbaimadai, and Port Kaituma. The commercial routes are important because they provide a cheaper and more dependable way to ship birds to Georgetown than waiting for a private flight. All of the domestic commercial routes allow traders to ship birds as cargo without buying a passenger ticket.

Rivers are the principal transportation route throughout much of Guyana where there are no roads. However, rivers become much more costly to travel in parts of the interior. Rapids, in particular, increase the cost of transportation in two ways (Figure 3.5). One, rapids have a heavy time and labor cost because of the need to portage rapids. Two, where there are rapids, there are more hazards for boats. As a result, there is a higher cost to maintaining a boat and motor in areas with rapids. A third problem with river navigation is the change in water level which can expose dangerous rapids or dry up altogether. The rivers on the coastal plain are the least likely to be affected by these problems, and this is where river transportation is the least expensive and most dependable.

3.3 VEGETATION ZONES AND THE DISTRIBUTION OF BIRDS IN GUYANA

Birds are not uniformly distributed in Guyana. However, most of the species targeted by the wild bird trade are found throughout the different regions of Guyana in significant numbers. Figures 3.3 and 3.5 illustrate the vegetation zones and topography in Guyana, which is dominated by lowland evergreen forest and patches of savannah and scrub (See Table 3.1). The genera *Sporophila* and *Oryzoborus* tend to have a patchier distribution because they are associated with savannah and scrub habitats. These two genera are most abundant in the major patches of savannah and scrub (see Figure 3.3), but they are not restricted to these areas. These species are represented throughout Guyana in small patches of habitat in the lowland forest. For example, they are often found along airstrips in the interior, or along freshwater areas such as streams and oxbows. In addition, there are six commonly traded species that have range restrictions in Guyana worth mentioning here. These are:

Amazona festiva. This species is the most range-restricted species that is commonly traded in Guyana. The only area where this species has been documented is along the northwest border with Venezuela. (Kratter, 1998) There has only been one record for this species in Guyana.

Ramphastos toco. This species is listed as doubtful for Guyana because there have not been any documented sightings (Braun et al. 2000). However, according to trappers and residents in the Rupununi, they are a seasonal migrant to southern Guyana from the Amazon basin.

Aratinga solstitialis. This species is only found in parts of the Rupununi Savannah. This species was by and large extirpated from Guyana during the ’70s and ’80s, and is no longer traded in significant numbers (Robbins et al. 2004).

Amazona dufresniana. This species is primarily restricted to western Guyana, and is most abundant near where the borders of Guyana, Brazil, and Venezuela meet. During part of the year this species may occasionally use habitats closer to the coast. However, *Amazona dufresniana* becomes increasingly scarce going east or south in Guyana. This species is still found as far east as the Iwokrama Forest in central Guyana, but it is the most scarce and local of the three species in the genus *Amazona* found there (Ridgely et al. 2005). This species has not been documented as far east as Suriname (Kratter 1998; O'Shea pers comm.).

Deroptyus accipitrinus is found throughout Guyana, but is more patchily distributed than other widespread lowland forest species. This species seems to prefer more upland areas, and is most abundant in the west near where the borders of Guyana, Venezuela, and Brazil meet.

Oryzoborus maximiliani is very rare, and not found anywhere in Guyana in significant numbers. *O. crassirostris* is only found in the southern Rupununi. The wild bird trade may be a major reason why these species are not found in areas with appropriate habitat, especially along the coast (O'Shea pers comm.).

Latin Name	ABU	Lowland Forest	Scrub	Savanna	Palm	Disturbed	Riparian
Amazona amazonica	5	X	X			X	
Amazona dufresniana	3	X					X
Amazona farinose	5	X					
Amazona festiva	1	X					X
Amazona ochrocephala	5		X	X		X	
Ara ararauna	4	X			X		X
Ara chloropterus	4	X					
Ara macao	4	X					
Ara manilata	5			X	X		
Ara nobilis	5		X	X	X	X	
Aratinga solstitialis	1		X	X			
Brotogeris chrysopterus	5	X	X				
Deroptyus accipitrinus	5	X					
Pionites melanocephala	4	X					
Pionus fuscus	5	X					
Pionus menstruus	5	X				X	
Ramphastos toco	1			X			X
Ramphastos tucanus	5	X					
Ramphastos vitellinus	5	X					
Oryzoborus angolensis	4	X	X	X		X	
Oryzoborus crassirostris	3		X	X			X
Oryzoborus maximiliani	1		X				X
Sporophila americana	4		X			X	
Sporophila bouvronides	3		X	X		X	
Sporophila castaneiventris	4		X			X	X
Sporophila intermedia	4		X	X			X
Sporophila lineola	3		X	X		X	
Sporophila minuta	5		X	X		X	
Sporophila plumbea	4			X			
Sporophila schistacea	1	X	X				

Table 3.1: Abundance and habitats for species in the wild bird trade. For abundance (ABU) codes, 5 means most abundant and 1 means most rare. (From Braun et al. 2000 and O'Shea, pers comm.)

Chapter 4: Methodology

This study is based on data collected in Guyana during the summer of 2003. Data was collected in Georgetown and during three trips in the interior. Each trip involved traveling to areas were birds were being trapped, and returning to Georgetown along the same transportation routes used to transport birds. Data collection consisted of a mix of archival research and research in the field, both of which are presented in detail below.

4.1 Analysis

This study analyzes the spatial relationship between harvesting pressure and markets at both the local and the national scale based on two sets of data. In addition, it examines the corresponding strategies used by actors in domestic production at each scale. As it is used in this study, "domestic production" starts when the bird is harvested in the wild and ends when the bird is either sold to a consumer or exported from the country. This study focuses primarily on two actors involved in domestic production, the trapper and the trader.

The first set of data includes 42 known trapping localities and the composition of species that are known to be trapped at each locality. This set of data is based strictly on interviews and includes only species composition, and not the relative volume of birds trapped at each locality. This data is the primary documentation of local patterns in harvesting pressure in this study.

The co-variation between the market value and distance from market was analyzed for both the highest and the lowest value species trapped at the known localities. This was done to evaluate the influence of market value on how far from market a particular species is trapped. The underlying assumption is that the cost of transportation is strongly correlated to the distance from market. This part of the analysis was restricted to parrots, and only localities (26) where parrots are harvested were included. The other localities were only used in the context of the toucan and songbird trade.

This part of the analysis was restricted to parrots for three reasons. One, parrots include the greatest number of species in Guyana's trade, and data on their trade was the most readily available. Two, finches have a drastically different cost of transportation, so it is inappropriate to compare them directly to parrots. Three, with toucans there was only significant data for one species, *Ramphastos toco. Ramphastos toco* was also excluded because it is so much more expensive that it is an outlier.

The distance to regional markets is evaluated in the analysis of local trade, and the distance to Georgetown is evaluated in the analysis of national trade. The regional market is defined as the location where the trapped birds are sold by trappers to traders. The regional markets used in this analysis include Mabaruma (6 localities), Charity (10 localities), Lethem (6 localities), and the east coast highway (4 localities). The east coast highway was used because there are numerous markets along this stretch of road, and the closest locations along the highway are where the birds are sold. A regional market was not included for the Kamarang area because there are no known trapping localities in that region. However, Kamarang is an important regional market in general, and it is used in the comparison of major regional markets.

Distance was measured using two methods. The first method was to use the measure tool in a geographic information system environment to estimate the Euclidean straight line distance from the trapping locality to the market. The second method was to model the relative minimum time that it takes to travel from a given trapping locality to the market using normal transportation routes. The travel time models were based on a cost-time grid of Guyana created in a geographic information system environment using data from the Digital Gazetteer of Guyana (Guyana Lands and Surveys Commission, 2001). The resolution of the grid was 100 meters. Each cell was assigned a specific cost measured in time. This value was based on the surface type (water, land, or road) and the slope of the terrain. These estimates are based on assumptions for how fast people travel on roads, waterways, or walking over land. Roads were reclassified into three categories: paved, maintained, and not maintained. In addition, the costs of traveling over water and land were recalculated based on slope to model the increasing time cost associated with steeper slopes. Finally, the time cost grid was used to model the time it takes to travel from any given cell in Guyana to Georgetown, and to each of the regional markets specified above.

The strength of the time cost models is that they estimate the time it takes to travel to a given location with a standardized method. The weakness of this method is that it assumes that it makes sense to travel the fastest route. However, the fastest route is not necessarily the least costly route. For example, it may be fastest to travel down a river with rapids, but if there is a large risk of damaging a boat it may not be the preferred route. In some cases it may make more sense to take an alternate route that is longer in both distance and time, but less costly.

The second set of data consists of the species composition and relative volume of regional production for four regions in Guyana. This set of data is based on both archival and field research. The co-variance between regional production and the relative cost of transportation to Georgetown is analyzed in order to evaluate the applicability of von Thunen's model at a national scale in Guyana (see section 2.1). Specifically, it allows for us to test the assumption that as the cost of transportation to market increases, the trade becomes more selective based on market value. In addition, for one species, *Oryzoborus angolensis*, data on the change in regional production over the previous thirty years is compared to the "overexploitation frontier" scenario described in section 2.2. The data on regional production is also compared to regional population density (based on Landscan 2002) in order to evaluate how variability in labor supply influences patterns in harvesting pressure.

One of the assumptions underlying most of this study is that there is a positive correlation between the cost of transportation and the distance from market. In reality, the cost of transportation varies considerably depending on the volume of birds, the mode of transportation, and other aspects of the trapper or trader's production strategy. At this point, it is not possible to model the cost of transportation over space beyond using travel time or distance as a surrogate. However, this study does describe the strategies in domestic production used by trappers and traders in order to contextualize how the cost of transportation changes over space.

4.2 DATA SOURCES

4.2.1 Archival Research

Two valuable archival sources of information were the flight manifests and the ferry records. These were extremely helpful for documenting the flow of birds within Guyana. For each domestic flight in Guyana, the captain must fill out a flight manifest that records all of the cargo going onto a plane. These manifests are then archived at Ogle field, the domestic airport that serves the capitol. These manifests did not record the number of individual birds or the species being shipped, but they do record the number of bird cages, and their weight. Ferry records added a more detailed insight into the wild bird trade, but only for the Northwest region in Guyana. Appendix B summarizes data from the ferry records and included more information about how ferry records are collected.

In addition, archival research was conducted at a number of ministries in Georgetown. The Bureau of Statistics provided data on demographics and exports. The library and personnel at the Guyana Geology and Mines Commission provided information on mining areas and how much gold and diamonds are coming out of different regions. The Lands and Surveys Commission provided a digital gazetteer of Guyana, an invaluable source of spatial data for Guyana. Other ministries that provided helpful information included the Lands and Surveys Commission, the Ministry of Agriculture, and the Guyana Forestry Commission.

4.2.2 Field Research

Field research consisted of direct observation and interviews. An attempt was made to directly observe every aspect of the trade, including trapping, transportation, sale, and holding of birds. Due to time limits, I was unable to go on a trapping expedition, although a number of trappers offered the invitation. However, trapping tools and demonstrations of trapping techniques that are employed in the finch, parrot, and toucan trades were observed.

Direct observation of the trade was invaluable for two reasons. First, it contextualized the information obtained by other means and provided a qualitative understanding of the trade. This helps put into perspective the environment in which decisions are made by trappers and traders. It also highlights certain limiting factors, such as the load capacity of a dugout canoe in the Northwest, or a bicycle in the Rupununi. Second, direct observation allowed for first hand documentation of species in the trade in different areas of Guyana. However, the most important source of information was interviews.

Formal and informal interviews were conducted with people involved directly and indirectly with the wild bird trade. With each person, the interviews covered their personal involvement, as well as their general knowledge of the trade. In each case, time was taken to explore the unique insight a person had into the trade. For example, with trappers, much time was spent on the process and costs of trapping different species. However, in every case, questions were asked about the quantity, transportation, price, cost, and demand for each species traded in a region.

The primary sources of information were the exporters (n = 6), domestic retailers (n = 6), finch trainers and “racers” (n=15), traders (n = 15), and trappers (n = 25). Whenever possible, a meeting was set up for the interview. Meetings were possible for all of the traders, and three of the exporters. With some individuals who had detailed knowledge of the trade, interviews were conducted during up to four different meetings. Three exporters were interviewed over the phone during one or two sessions each. For the most part, trappers were contacted at regional markets where the birds are sold. Since they did not tend to stay long there was often little time to set up an interview. Most trappers were interviewed at markets while they waited to sell their birds. Interestingly, trappers were the least inhibited about discussing the trade, and many had a strong interest in learning about how the rest of the trade works. Trappers, traders, and retailers in the domestic songbird trade were generally less inhibited than those involved in the parrot and toucan trade. Information was corroborated by people indirectly involved in the wild bird. For example, Boatmen, truckers, pilots, and cargo handlers from domestic airlines and ferries were interviewed.

During interviews with people who had an intimate knowledge of trapping areas, a map of Guyana was used to identify trapping locations and the species known to be trapped there. This map used is named “Guyana Map, 1 ed”, and it is published by Treaty Oaks as part of its “International Travel Maps” map series. This map had a scale of 1: 850,000. It was useful for locating trapping areas because it displays topography, hydrography, permanent settlements, and roads.

Interviews were also essential for establishing the market value of different species. Market value as it is used in this study refers to the price that a seller can expect to sell a bird for on the open market. Prices of birds were documented through interviews and first hand observation. In the parrot and toucan trade, interactions between trappers and traders were observed, but interactions between traders and exporters were not. However, a survey of traders demonstrated that there is a consistent price for each species. One trader provided a price list that covered all the species that he traded. The price exporters sell birds for was not documented, and all exporters were unwilling to share such information due to competition and government regulation. However, Guyana's Wildlife Division provided the official export value of legally exported species. See Appendix C for a review of species prices in Guyana for the trapper, the trader, and the exporter.

Chapter 5: Patterns in Domestic Production

This chapter is divided into four parts. Part one analyzes local patterns in harvesting pressure and associated trapper strategies. Part two compares the trader's cost of transportation for different regions in Guyana, and is directly relevant to parts three and four. Part three analyzes the differences in regional production in the parrot and toucan trade in relation to transportation cost and regional population density. Finally, part four analyzes the data available for Guyana's finch trade, focusing on the history of the trade in *Oryzoborus angolensis*.

5.1 Local Patterns Harvesting Pressure

In Guyana there are two wild bird trades that are carried out side by side, the export-oriented parrot and toucan trade, and the domestic finch trade. For the most part, these two trades are carried out separately and do not involve the same individuals. The exceptions primarily involve traders who work in both types of trade. Figure 5.1 illustrates that while there are some important differences between the two, the first two tiers are very similar. Most importantly, the spatial scale of trapper and trader participation in the trade is essentially the same. For both, the trapper works at a local scale, trapping birds and transporting them to the regional market, and the trader works at a national scale, buying birds at the regional market, and transporting them to Georgetown. The biggest differences occur once the birds get to Georgetown. The finch trade is primarily consumed in Guyana, and the parrot and toucan trade is primarily exported to foreign markets.

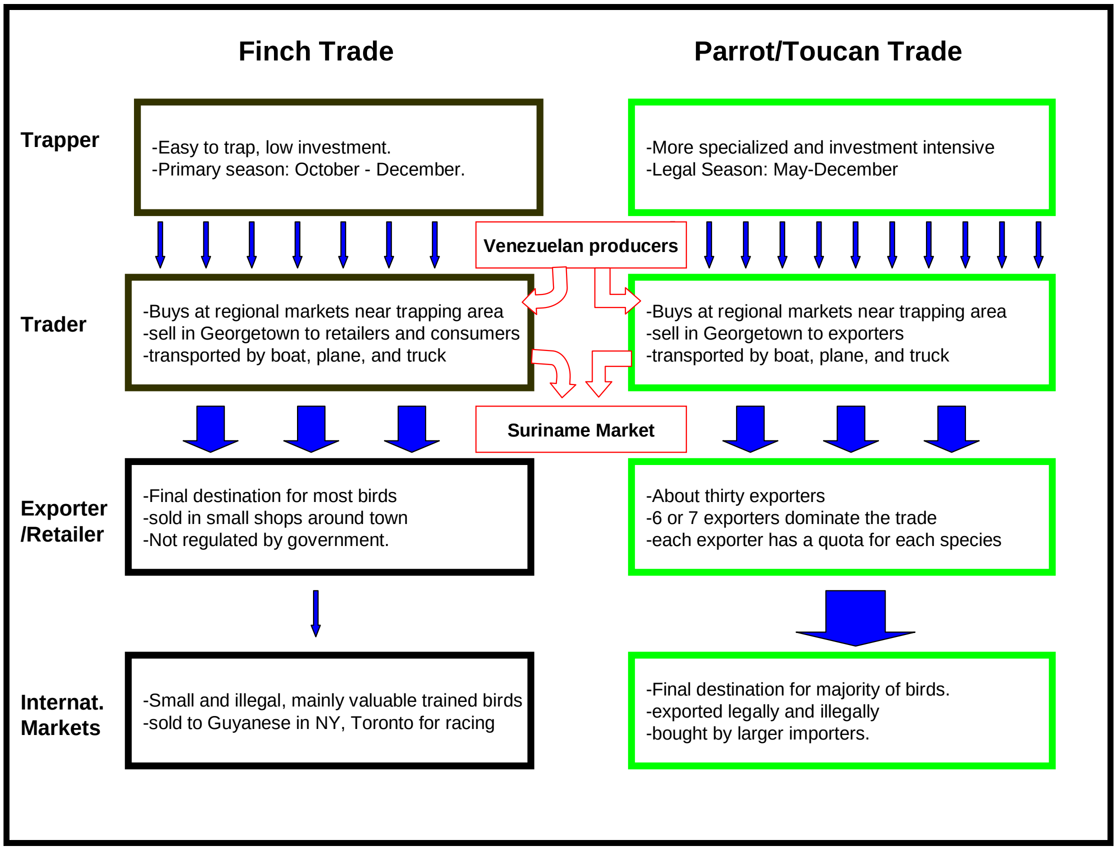

Figure 5.1: Comparative flow chart of Guyana's wild bird. Vertical blue arrows represent the relative number of agents and volume at each step in the harvest regime. Red represents the presence (not volume) of illegal cross border trade.

The first stage in the trade involves trapping and transportation to the regional market. Figure 5.2 is a generalized illustration of the flow of birds from the trapping areas to the important regional markets in Guyana's wild bird trade. Trapping localities can be up to 150 kilometers from the regional market. As predicted by von Thunen's model, as the distance from the regional market increases, the trade becomes more selective based on market value. Below are four plots (Figures 5.3-5.6) that compare the trapper price with the relative distance to the regional hub for 26 known trapping localities where parrots are harvested.

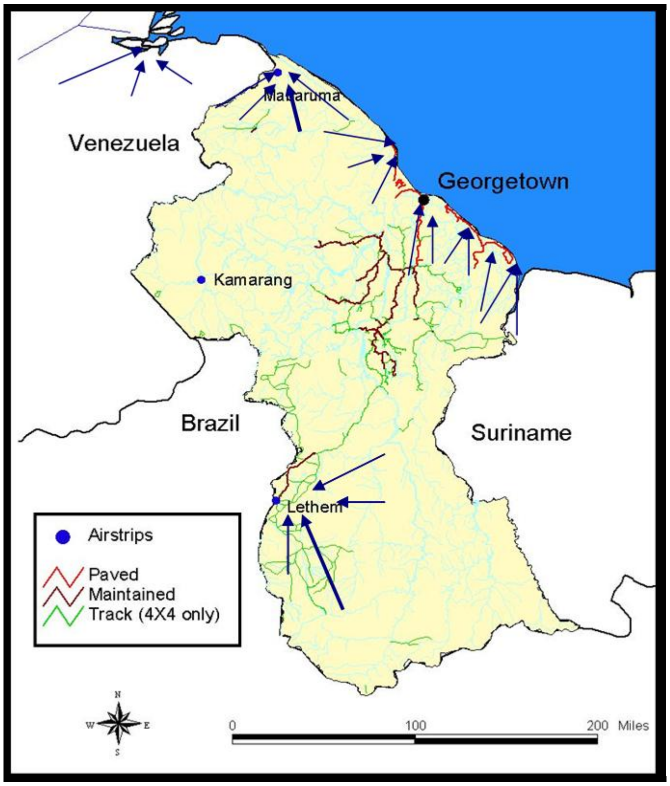

Figure 5.2: Map of local trade. Blue arrows depict the flow of birds from the areas where wild birds are trapped to the regional markets where the birds are consolidated before being shipped to Georgetown.

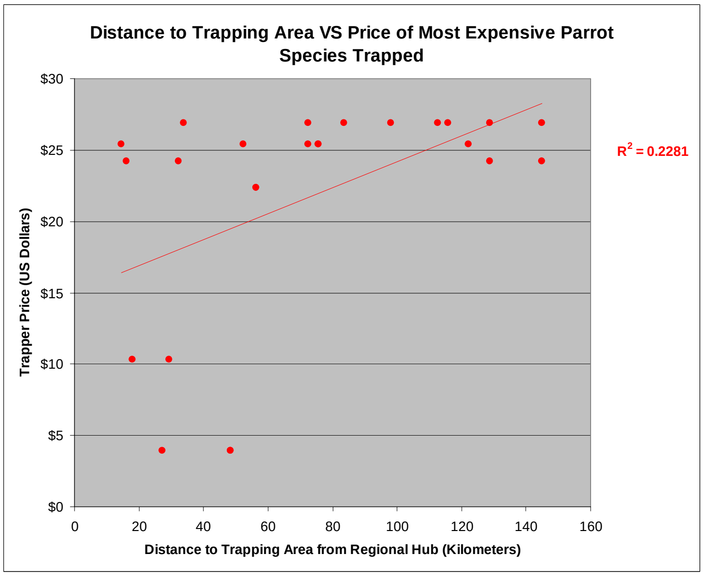

Figure 5.3: Distance to regional market versus maximum market value. This plot compares the price of the highest value species of parrot trapped at a given trapping locality to the distance between that trapping locality and the regional market.

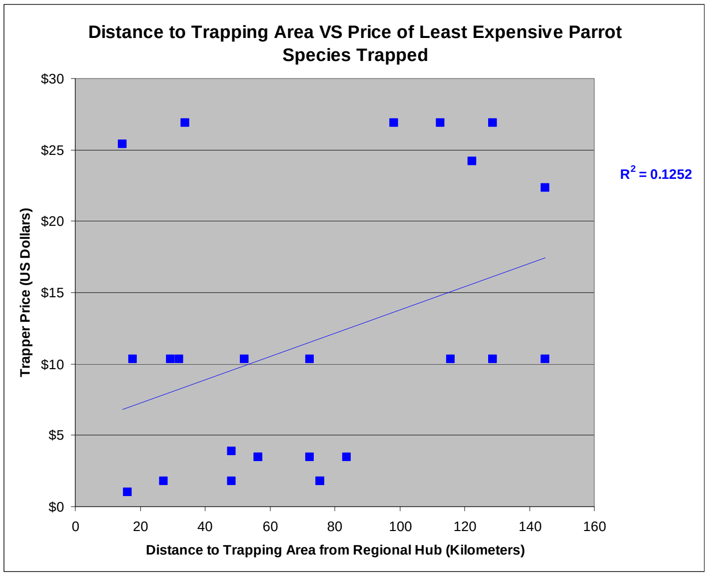

Figure 5.4: Distance to regional market versus minimum market value. This plot compares the price of the lowest value species of parrot trapped at a given trapping locality to the distance between that trapping locality and the regional market.

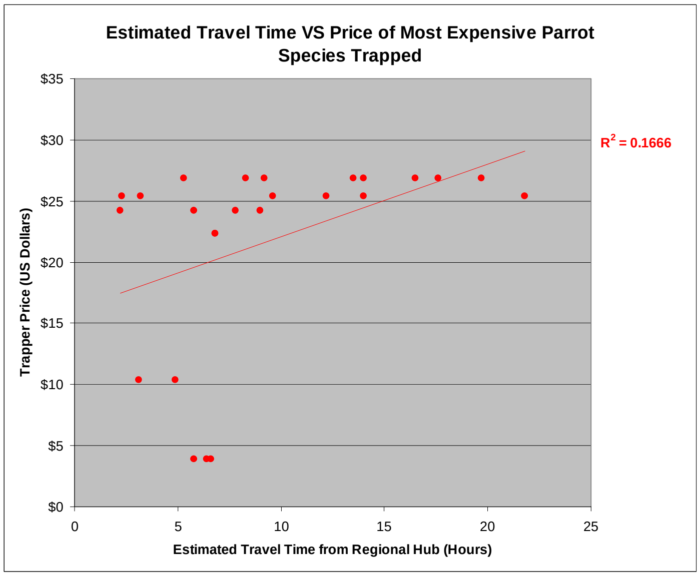

Figure 5.5: Local travel time versus maximum market value. This plot compares the price of the highest value species of parrot trapped at a given trapping locality to the estimated travel time from that trapping locality to the regional market.

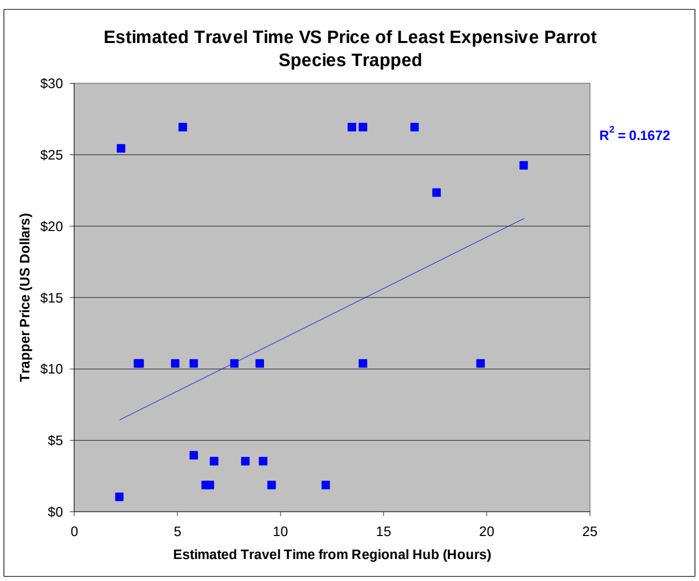

Figure 5.6: Local travel time versus minimum market value. This plot compares the price of the lowest value species of parrot trapped at a given trapping locality to the estimated travel time from that trapping locality to the regional market.

The trapper price for parrots is easily classified into three categories. Species with a trapper price over $20 can be considered high value species. All species with a price under $5 can be considered low value species. The one species that has a trapper price of around $10 can be considered a mid value species (see Appendix C for data on species prices).

Figures 5.3 and 5.5 demonstrate two patterns. One, high value species are trapped regardless of how far from market the trapping locality is. This makes sense because high value species are always more profitable than low value species. Two, there are few trapping localities where they only trap low value species, and all of these localities are within 50 km, or about 7 hours travel from the regional market. This can be explained in part by the fact that most trapping localities have at least one high value species. But this also suggests that beyond about 50 km or 7 hours travel, it is no longer profitable to trap only low value species. Figures 5.4 and 5.6 are even more interesting because they show how far from market a trapper will trap low value species. Beyond 85 kilometers, or about 12 hours from the regional market, parrots worth less than $5 dollars are no longer trapped. But at the majority of these localities, the low value species are trapped along with high value species.

This data suggests that local patterns in harvesting pressure are consistent with von Thunen's model. In the closest localities the trade is the least selective, and any species is trapped regardless of market value. As the distance from market increases, the trapper become more selective, only trapping in localities with a mix of high and low value species. Finally, at the greatest distances, the trappers become the most selective, only trapping high value species.

However, transportation cost is not the only possible reason why trappers become more selective at greater distances from market. The options trappers have suggest that transportation cost per kilometer does increase as distance from market increases. However, there are additional costs of production that are associated with the distance from the regional market.

Trapper behavior can be divided into two categories, trapping birds and selling birds at the regional market (see Appendix D for information on trapping techniques). The trapper faces transportation costs associated with both actions unless he traps and sells birds where he lives. Trapping and selling will be dealt with separately below because the trapper faces different transportation options in either case.

When trapping birds, a trapper can either trap around where he lives, or he can go on an extended trip to an area where high value birds are abundant. Trappers in all regions reported both types of strategies. Trapping close to home has many advantages and evidence of active trapping efforts was observed in and around many communities. One advantage is that the cost of transportation is minimized, but there are other reasons why this is cost effective. Trapping close to home allows the trapper to maximize his time by trapping during periods when the birds are most active, and then spending the rest of the day working on his farm or whatever else he does. In effect, he is a part time trapper. In addition, trapping around the home minimizes the cost of holding and feeding birds around the home. Often, they will just clip their wings and leave them in a tree in their yard.

Trapping trips are much more costly than trapping around home because of four reasons. First, transportation to and from the trapping area often requires a considerable investment in gasoline. Second, a trapping trip is a full time job with higher labor cost compared to a part time trapper. Third, trips require a much higher initial investment for provisions for the trip and materials for holding the birds in the field camp and for transporting the birds. Fourth, because there is a bigger investment there is a bigger risk involved in this strategy. If, for example, it rains the entire week, it is possible the trappers could lose their investment and return empty handed. While transportation cost does significantly increase, the very fact that the trapper is going on a trip requires a higher yield to be profitable.

In the northwest and the northeast trappers reported going on two-person trapping trips lasting five days to a week and costing the equivalent of over $100 US for supplies such as gas, food, and trapping supplies. This is a significant investment in a region where the typical day's wage is only $5. Gas makes up the majority of this cost. This cost does not include the cost of the two trappers' time, the cost of transporting the birds to market, or the risk of losing birds to mortality. When these expenses are included, the total cost of one trapping trip could easily be $200. The Figure 5.7 illustrates the cost curve for a trapping trip with an initial investment of $100 and a total cost of $200.

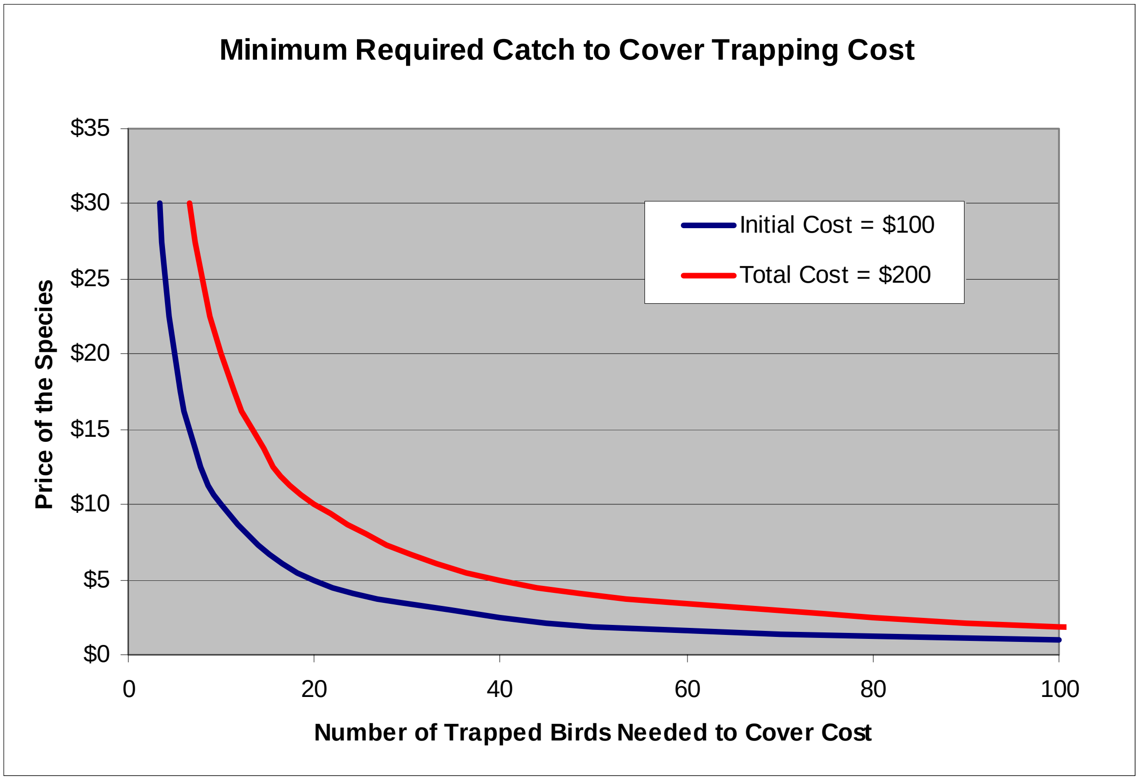

Figure 5.7: Typical Cost curves for a two person trapping trip. $100 is the initial investment for supplies required on a trapping trip. $200 is the total cost of the trip, including the two trappers' time, the cost of keeping the birds until they can be sold, the cost of getting the birds to market, and the risk of losing birds to mortality.

Figure 5.7 illustrates how sensitive the trapper's cost curve is to changes in the price of the species being trapped. Basically, trapping trips are only profitable for high value species, or for species trapped in large volumes. For a species worth less than $5, the trappers have to trap a minimum of 20 birds to cover the initial investment, and at least 40 birds to cover the total cost. By comparison, for a $20 species, trappers would only have to trap 5 birds to cover their initial investment, and ten birds to cover the total cost.

For comparison trappers reported that they could catch between 5 and 25 *Ara ararauna* (Trapper price = $24.21) in a week and they considered 15 macaws a "good" week. Trappers also reported that they could trap between 25 and 40 *Amazona amazonica* (trapper price = $3.49) in one week of trapping. This species is one of the most common and easily trapped species of parrots in Guyana. But even if trappers caught 40 birds, it would still not cover the initial investment required to go on a $100 trip.

In the Northwest trappers reported going on trapping trips by boat for *Ara ararauna, Ara chloroptera, Deroptyus accipitrinus, Amazona dufresniana, Amazona ochrocephala*, and *Pionus fuscus*. On the Courantyne River, in northeastern Guyana, trappers reported going on lengthy trapping trips for *Ara ararauna, Ara chloroptera*, and *Ara macao*. Trappers can sell all of these species for over $20 each with the exception of *Ara macao* (trapper price = $16.76). In addition, trappers in the Rupununi reported going on trapping trips by boat (up to 1.5 hours) on the Rupununi River for *Ramphastos toco*. *Ramphastos toco* is unique because its market value (trapper price = $130) is incredibly high and one bird is more than enough to cover the expense of such a boat trip.

In the Rupununi trappers also reported going on extended trapping trips by bicycle, which is the most common form of transportation in the Rupununi. The advantage of the bicycle is that it has a low maintenance and fuel cost. The drawback is that bicycles cannot carry nearly the volume of birds compared to a boat and it takes longer resulting in a higher labor cost. The trappers can compensate for the small load capacity by trapping extremely high value species compared to their volume: *Ramphastos toco* (trapper price = $130), *Oryzoborus angolensis* (trapper price = $5.77), and *Oryzoborus crassirostris* (trapper price = $11.17). Trappers reported going as far as 100 kilometers by bicycle on a sand track to trap, but 10 to 30 km trips are much more common. Both of the *Oryzoborus* are not high value species compared to parrots, but because they are so much smaller in size, their market value relative to their transportation costs is much higher. A trapper on a bicycle can easily transport 30 birds or more in a single cage.

Selling birds in market introduces a different set of transportation costs which add to the trapper's overall cost of production. These costs vary greatly depending on the options available to the trapper, which depend on where he is relative to the regional market. Often the trapper will transport his birds along with other goods that are being transported to market. In many communities, trappers will trap birds, clip their wings, and keep them around their house until such an opportunity presents itself to get them to market (see Figures 5.8 and 5.9).

In the Rupununi, trappers will take advantage of trucks with extra space to transport birds to Lethem (see Figure 5.10). In the northwest where the economy is dominated by small scale farmers, the transport of agricultural products to market is a cheap and plentiful mode of transport trappers. Often the trappers themselves are also bringing produce to market. Bringing a cage with a few parrots does not add additional cost but in some cases can be worth more than the entire boatload of produce.

This strategy is only an option when the trapper is bringing goods to market, or when the trapper has access to dependable trade to the regional market. In Guyana, this is a major limiting factor, and the farther away from a regional market, the less trade there is. In communities with many trappers, they can split the cost of transportation and bring the birds to market in one load (Figure 5.8, top). In effect, the other trapper's birds are the "other goods."

Figure 5.8: Trapper's transport cages. Top: A group of trappers arrive in Mabaruma with 92 parrots (genus *Amazona*) caught by many different trappers in the same community. Left: Trapper's cage with 20 *Amazona farinosa*. Right: Trapper's cage made out of palm fronds with about 15 parrots (genus *Amazona*).

Figure 5.9: Market day in Morawhanna where farmers bring produce, wild birds, and other products to sell (left) and Charity where the road ends in Northwest Guyana (right).

Still, in some cases the trapper will transport the birds to market on his own. This is the most common strategy in the Rupununi where the trade is dominated by species with high market values relative to their transportation costs. Traders in Lethem report that approximately 80% of the birds (finches, parrots, and toucans) they buy are brought to Lethem by the trapper on a bicycle (See Figure 5.10).

Figure 5.10: Transportation for the trapper in the Rupununi. Bicycles are commonly used for transporting goods; the top right picture includes macaws that are prepared for shipment to Georgetown. Bottom: some birds (approx 20% according to traders) are brought to Lethem by truck.

Of course, this raises a question: if trappers are transporting high value species either on trapping trips or to market, why don't they add low value species? Within a certain distance they do. Figures 5.3 through 5.6 show that trappers will trap low value species (trapper price < $5) twice as far from market if they are also trapping high value species (trapper price > $20). However, the influence does not extend beyond 100 km or about 12 hours from the regional hub. From 45 kilometers to 100 kilometers the proportion of cheap species to expensive species probably goes down as the cost of production increases. Anecdotal information from trappers who work in multiple areas does support this. Unfortunately, data on the relative volume of different species trapped at each of the trapping areas is not available. This assumption should be tested because more data may prove that beyond 100 km trapping requires a significant increase in investment.

The local pattern in harvesting pressure is consistent with von Thunen's model. However, the relationship between the cost of transportation and the distance from market is not a straightforward linear relationship. Trapping trips require a great cost in supplies and labor that are not directly related to the distance of the trapping trip. On the other hand, the availability of cheap transportation to market can greatly reduce the overall cost of transportation. As a result, there are likely to be two important thresholds associated with the cost of transportation within a region. The first is the distance at which cheap transportation to market is still available. The second is the distance from trapper communities at which trappers start making extended trapping trips.

The following sections will look at the spatial patterns in harvesting pressure at the national scale for the parrot and toucan trade, and then the finch trade. But first, section 5.2 will describe the variability in regional transportation costs for the bird trade in Guyana.

5.2 TRANSPORTATION FROM REGIONAL MARKETS TO GEORGETOWN

There are three primary means that traders use to transport birds to Georgetown from the regional hubs: road, ferry, and plane. Paved roads are the fastest, but they are limited to the central and East coast of Guyana. The majority of the country does not have roads, or the roads are unpaved. According to exporters and traders, parrots and toucans cannot be shipped for long distances over rough roads because it is too stressful for the birds. However, this is apparently less of a problem for transporting *Oryzoborus* finches which are commonly shipped from the Rupununi by truck (Figure 5.11). According to two trucker-traders who work the Lethem route, there are about 15 truck-traders that work between Lethem and Georgetown, and only four or five trade birds.

Figure 5.11: The trans-Guyana highway. Goods are commonly transported by rugged four wheel drive Bedford trucks (Left). Right: This is the only road that connects Georgetown to Lethem and most of southern Guyana.

One of the most important forms of transportation used by traders is the ocean going Mabaruma ferry (Figure 5.12), which connects the northwest corner of Guyana to

Georgetown. This ferry makes the round trip every two weeks, each way taking over 26 hours. Critical to the local economy, the ferry brings in essentials such as flour, sugar, rice, and gasoline. On the trip back it takes farmers' produce and natural forest products. The Northwest has traditionally been the most important area for parrot trapping in Guyana, and the ferry provides a cheap way of getting the birds back to Georgetown. During the two weeks between trips, traders will buy birds on the dock in Kumaka, and keep them in large cages that can hold over a hundred birds each. These cages are placed on the deck of the ferry, where the birds can be easily fed and cared for during the journey. Although the trip is long, and somewhat arduous, it is also very cheap. Per person, it only costs $8.38 and a two-person team can transport hundreds of birds in a single trip. The ferry charges $2.65 per normal cage, and $3.97 per macaw cage. In addition, the ferry charges a flat rate of $2.79 for each dozen birds. This works out to be a total cost of around 40 cents per macaw, and about 26 cents each of the other parrots. This does not include the cost of labor, but the ferry has the lowest labor cost per bird because one or two people can transport 300 to 500 birds on the ferry.

Figure 5.12: The northwest ferry. Left: Traders loading their parrot cages onto the ferry at Kumaka. Right: The ferry at sea. There are over 1,000 parrots in the cages in this picture. The brown bundles below are bark, used for tanning leather.

The third means of transporting birds to Georgetown is to ship birds by air (Figure 5.13). Most often, a trader will put them on a plane in the interior, and the exporter, or another trader will pick them up at the airport in Georgetown. This way there is not the expense of a seat on the plane, but it is still the most expensive way to ship birds. There is a minimum charge of $5.60 for each cage, and they also charge according to weight for heavier cages. The cages used to transport songbirds are light, often made of cardboard, so they only cost $5.60 per cage. However, all parrots and toucans require heavier cages, so the total cost per parrot or toucan cage adds up to $20 or $30. Each cage can only carry 5 – 10 macaws, and up to 30 of the smaller species. Because of the high cost of transportation, traders usually only ship birds by air if they are delicate or they are high value species. Exporters specifically mentioned Red-fan Parrots (*Deroptyus accipitrinus*), toucans, and Dusky Parrots (*Pionus fuscus*). This is not true for the finch trade because you can put many finches in a single small cage or cardboard box (see Figure F.3). Airport personnel also reported that finches are often shipped in cardboard boxes because they weigh less and cost less. For macaws, shipping by air cost $2 to $6 per bird. For smaller parrots such as *Amazona amazonica* this price goes down to about $1 per bird. However, for songbirds such as *Oryzoborus angolensis* this cost can be as low as 10 cents per bird.

For some areas, such as Lethem and Kamarang, planes are the only means of shipping parrots and toucans to Georgetown. Exporters reported that toucans are commonly shipped by plane from Mabaruma, despite the ferry option, because it is easier on the birds. In addition, traders in Mabaruma will often ship macaws by air if the ferry is not scheduled to come soon. This saves them the expense and labor of feeding them for up to two weeks. Airport personnel and flight manifests confirmed that birds are regularly sent from Mabaruma to Georgetown by plane.

Figure 5.13: The transportation of birds by airplane in Guyana.   Left: The wooden box on the trolley is used to ship macaws. This plane just arrived from Lethem. Right: *Oryzoborus* finches are often shipped in cages (3 in picture) and cardboard boxes (2 in picture) that can hold up to 50 individual birds. In addition there is a wooden box with parrots on the luggage trolley.

In addition to the cost of transporting birds, traders also must deal with the cost of transporting themselves to the regional markets. Even if the trader does not have to personally oversee the transportation of the birds to Georgetown, he must maintain business contacts in both the regional hub and in Georgetown. This is especially important in the bird trade because it is highly seasonal, even within the trapping season (see Figure B2 in Appendix B). The trade must be constantly aware of the market for each species, and he must communicate that information to the trappers he buys from. The cost of maintaining these ties cannot be easily quantified because it depends on the volume of birds being traded and the frequency of trips by the trader. However, the difference in the cost of doing business in different regions is dramatic.

5.3 National Patterns in the Parrot and Toucan Trade

The volume of trade and the species traded vary greatly between the different regions in Guyana. Figure 5.14 illustrates the major trade routes that connect regional hubs to Georgetown. This section reviews the differences in trade between the different regions, and evaluates the influence of the cost of transportation and the region's human population size.

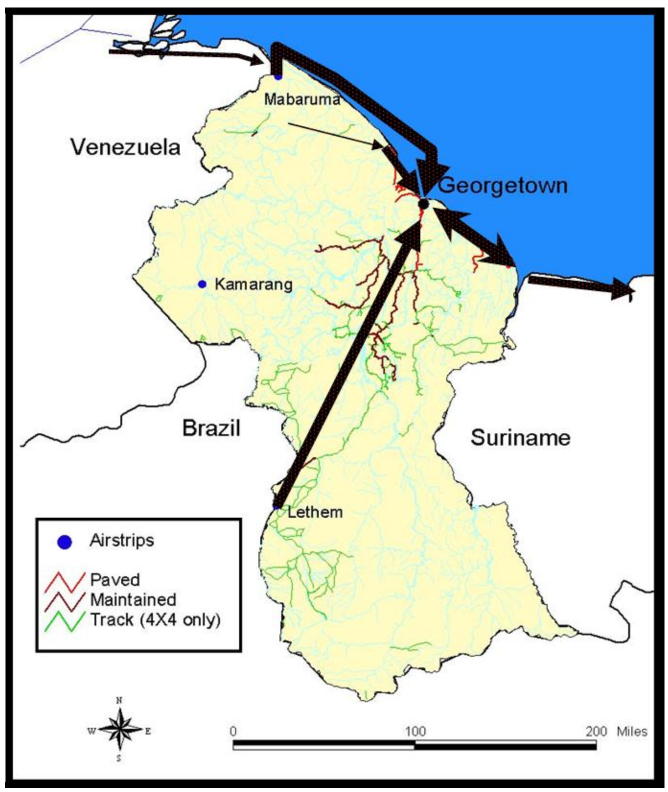

Figure 5.14: Map of national trade. The arrows on this map illustrate the major trade routes (not volume) that connect the regional hubs to Georgetown. Note that the trade goes in two directions on the East Coast representing the flow toward Georgetown, and the illegal trade toward Suriname.

As Figures 5.15 and 5.16 demonstrate, the impact of the distance to Georgetown has a similar impact as the distance to the regional market. Beyond 7 hours from Georgetown, trappers stop buying low value parrots (trapper price < $5) unless high value parrots (trapper price > $20) are also trapped. Beyond 12 hours from Georgetown low value species are no longer trapped, and mid value species (trapper price ~ $10) are only trapped when high value species are also trapped.

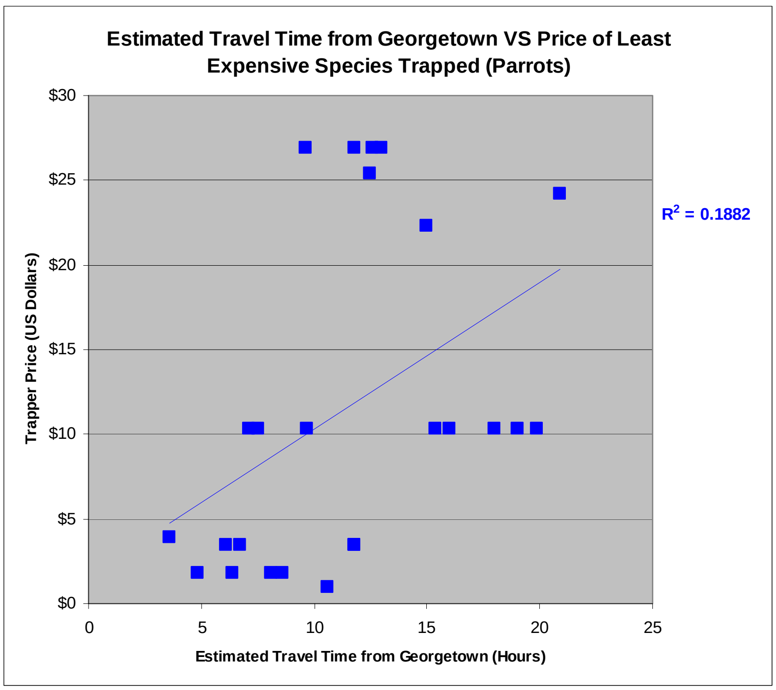

Figure 5.15: National travel time versus minimum market value. This plot compares the price of the lowest value species of parrot trapped at a given trapping locality to the estimated travel time from that trapping locality to Georegtown. Note that trappers do not trap parrots worth less than $5 over 12 hours from Georgetown.

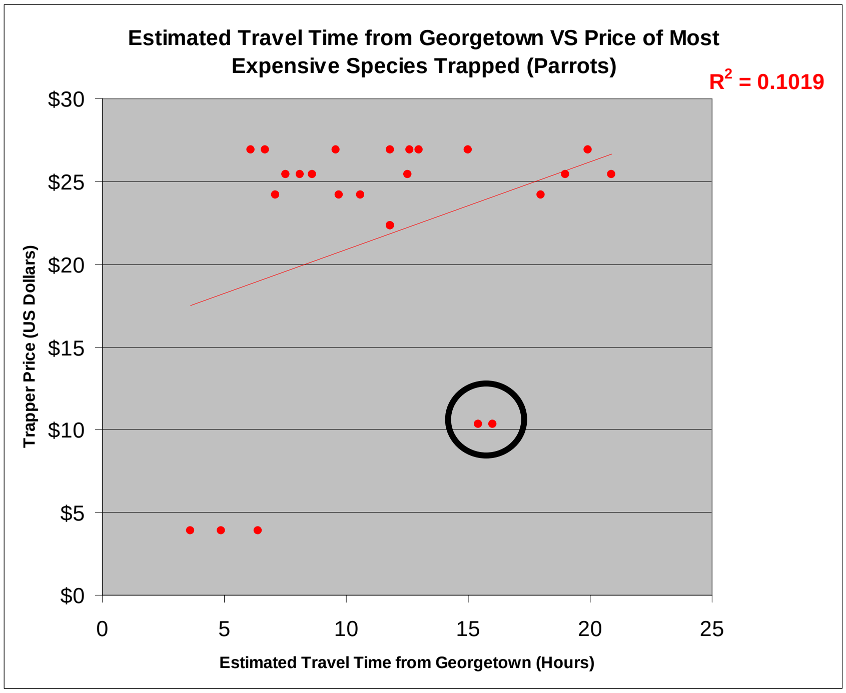

Figure 5.16: National travel time versus maximum market value. This plot shows that all trapping areas over 7 hours from Georgetown supply high value parrots (trapper price > $20). The two exceptions (circled in black) were *Amazona ochrocephala* that are trapped in the same area as *Ramphastos toco* (trapper price = $130) which was not included in this analysis because it is an outlier.

There is also a significant difference when comparing the local analysis to the national analysis. In Figure 5.16, it is clear that there are no high value species that are trapped within 6 hours of Georgetown. This may be partly explained by the lack of data for trapping areas near Georgetown, and the fact that few trapping areas are around Georgetown. However, this also suggests that the populations of high value species (especially the large Macaws) that were historically found around Georgetown have been greatly reduced.

Unlike the local patterns in production, these patterns could be a product of either the trapper or the trader's behavior (or both). However, by examining what species traders will buy at different regional markets, it is clear that the traders reinforce this pattern by only buying more expensive species in more distant regional markets. Table 5.1 shows that traders only buy low value species when they can transport them back by ferry or paved road.

Parrots/Toucans	**Trapper price**	**East Coast**	**Charity**	**Mabaruma**	**Lethem**	**Kamarang**
Transportation to Georgetown		**Paved Road**	**Paved Road**	**Ferry Airplane**	**Airplane**	**Airplane**
Transportation cost per bird		**?**	**?**	**26-40 cents**	**$1-$6**	**$1- $6**
Percentage of trade		**30%**	**10%**	**50%**	**10%**	**<1%**
Ramphastos toco	$130.17	**X**	**?**	**?**	**X**	
Deroptyus accipitrinus	$26.89	**X**	**X**	**x**	**x**	**x**
Ara chloropterus	$25.42	**X**	**X**	**x**	**x**	
Ara ararauna	$24.21	**X**	**X**	**x**	**x**	
Amazona dufresniana	$22.35		**X**	**x**		
Amazona festiva	$22.35			**x**		
Amazona ochrocephala	$10.34	**X**	**X**	**x**	**x**	
Ramphastos vitellinus	$6.98	**X**	**X**	**x**		
Ramphastos Tucanus	$6.98	**X**	**X**	**x**		
Amazona farinose	$6.33	**X**	**X**	**x**		
Diopsittaca nobilis	$3.91	**X**	**X**			
Amazona amazonica	$3.49	**X**	**X**	**x**		
Orthopsittaca manilata	$2.79	**X**	**X**			
Pionites melanocephala	$1.82	**X**	**X**	**x**		
Pionus menstruus	$1.00	Unknown	Unknown	**x**		
Pionus fuscus	Unknown	Unknown	**X**	**x**		

Table 5.1: Species trapped in each region. ? = Reported, but very rare. Data based on direct observation, as well as interviews with traders and exporters. The trapper price is about the same as the trader's markup which is generally 100%. (See Appendix C)

All five exporters in Guyana that would discuss where parrots and toucans are trapped in Guyana reported that around 60% of the parrot and toucan trade is supplied by the Northwest district, 30% by the east coast rivers, and another 10% comes from the Rupununi. These estimates are supported by information from traders and documentation from each of the regions (See Appendix B).

In regions without paved roads or a subsidized ferry the only transportation option is an airplane. This limits what species can be profitably trapped in the region. However, the cost is not only limited to the cost of shipping the birds. The trade depends on communication between the trader and the trapper as to what species are still in demand. This is especially important in Guyana because the trade is inconsistent throughout the year. (See the ferry records in Appendix B**).** In areas mostly accessible by air there is an additional cost to maintaining that communication, which often involves the trader making regular trips to the region. 90% of the birds trapped in Guyana are from regional hubs that are connected to Georgetown by paved road or subsidized ferry. Although the Rupununi supplies a small portion of the overall trade, it supplies a significant percentage of the high value species (trapper price > $20).

Transportation costs have a strong influence on the difference in trade between the different regions, but these costs alone do not explain the overall pattern in trade. Another factor is the population of the region (See Table 5.2 and Figure 5.17).

REGION	Portion of export trade	Area (Km2)	Total population	MEAN Pop density (people/km2)
Rupununi	10%	44381	14655	0.33
Kamarang	0%	18728	3172	0.17
Northwest	60%	19294	22515	1.17
East Coast	30%	31961	504253	15.82

Table 5.2: Parrot and toucan trade volume by region.

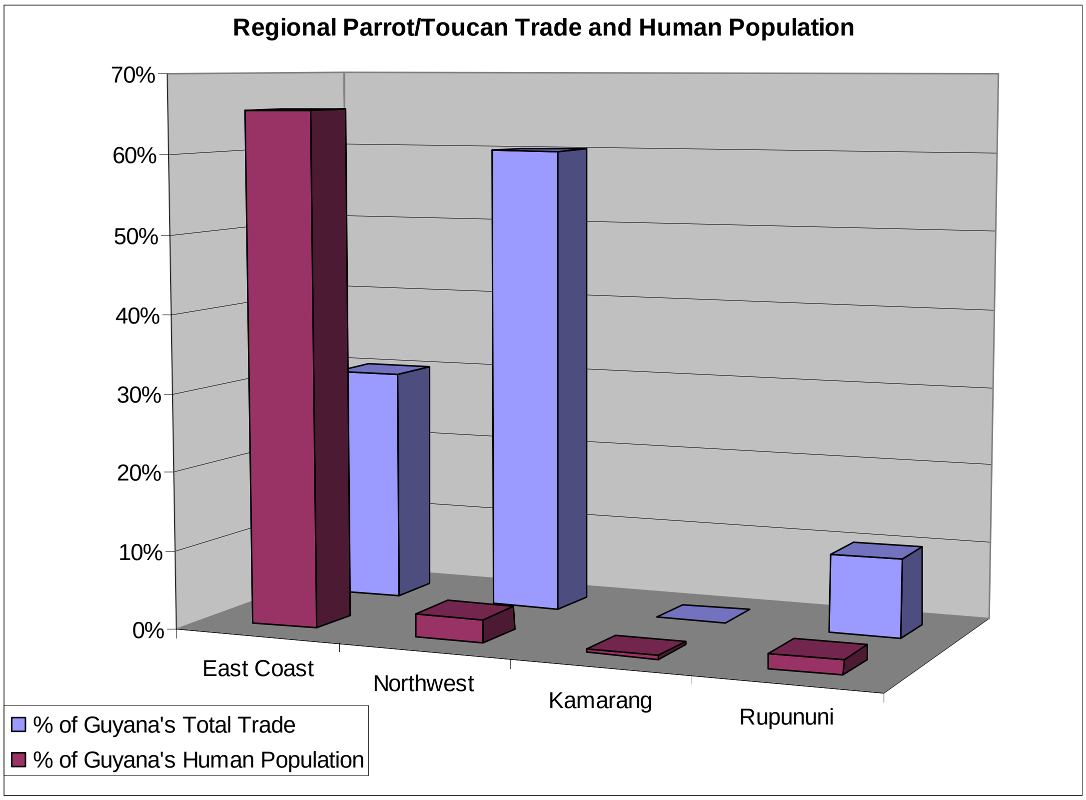

Figure 5.17: Comparison of the bird trade and human population for four regions in Guyana. The total human population for Guyana is about 770,000. This only represents the parrot and toucan trade, not the songbird trade.

Although population is not directly correlated with trapping activity in different regions, it can act as a limiting factor. The extremely low volume of trade in Kamarang cannot be explained strictly by transportation costs because it is actually cheaper to ship birds from Kamarang (or nearby Imbaimadai) than it is from Lethem. The lack of trade cannot be explained by bird abundance since it has the most abundant populations of two highly sought after species: *Amazona dufresniana* and *Deroptyus accipitrinus*. The lack of trade from Kamarang can be explained by the lack of trappers due to a smaller local population and a more competitive economy due to mining. This conclusion is supported by both traders and exporters that reported that they could not afford to work the Kamarang area because there were not enough trappers.

5.4 Spatial Patterns in Guyana's Finch Trade

There are at least five species of songbirds that are commonly traded in Guyana, but the trade is dominated by one species, *Oryzoborus angolensis*. This species is the species of choice in Guyana for finch racing enthusiasts (see Appendix E). According to finch racers, *Oryzoborus crassirostris* used to be the most popular bird in Guyana, and still is among the older generation.

Species	Trapper price	East Coast	Mabaruma	Lethem	Kamarang
Oryzoborus crassirostris	$8.38		**x**	**x**	
Oryzoborus angolensis	$5.77	**10%**	**10%**	**80%**	**<1%**
Sporophila lineola	$0.80	**x**			
Sporophila bouvronides	$0.80	**x**			
Sporophila minuta	$0.56	**x**			
Sporophila castaneiventris	$0.56	**x**			

Table 5.3: Known sources of six species of songbirds sold in Georgetown. The relative volume of *Oryzoborus angolensis* is included because there was much more data available for this species. According to traders, the Mabaruma birds are most likely coming from Venezuela, and not Guyana.

Like the parrot and toucan trade, the trade in songbirds becomes more selective in regional markets with a higher cost of transportation. According to three different retailers with at least ten years experience in the trade, 80% of the *Oryzoborus angolensis* being sold in Georgetown come from the Rupununi (Lethem). However, this pattern has changed considerably over the last 50 years.

Historically the primary trapping areas for *Oryzoborus angolensis* were along the coast. Some of the older finch enthusiasts reported that this species was trapped on the outskirts of Georgetown about 50 years ago. According to trappers and Georgetown retailers, up until the early to mid 1990s, 80% to 90% of the *Oryzoborus angolensis* trade came from the savannah and scrub patches along the Berbice, Mahaica, and Mahaicony rivers. These are the closest major patches of habitat suitable for *Oryzoborus angolensis*. The only other region with significant patches of suitable habitat is the Rupununi.

In the late nineties retailers and traders in Georgetown reported that there was a big shift towards the Rupununi because the birds in the areas along the East Coast were becoming scarce. One trader reported that if he went to areas along the east coast he might be able to buy 30 or 40 birds, but in the Rupununi he can still buy a few hundred per trip.

Trappers and traders around Lethem also reported this dramatic increase in Rupununi trapping. According to one trapper who has been trapping full time in the Rupununi for the last 33 years, in the 1980's there were about 30 to 40 *Oryzoborus* trappers in the Rupununi and they did not start trapping *Oryzoborus angolensis* until 1986. In 2003 this trapper and local traders estimated that there were currently about 200 "serious" trappers in the Rupununi. In addition, according to retailers and trappers, during this same time the there has been a consistent increase in the value of *Oryzoborus angolensis*.

There is a third region in Guyana with significant patches of savannah and scrub habitat, the Kamarang area. These patches do not compare in size to the areas near the coast, or the Rupununi, but they are known to have healthy populations of *Oryzoborus angolensis*. According to a major retailer in Georgetown, birds from the Kamarang area are also highly sought-after because they have a reputation for being very competitive birds. However, as in the parrot and toucan trade, retailers in Georgetown say that they are unable to get them because there are not enough trappers in the area.

In the Rupununi, *Oryzoborus* trappers reported catching anywhere from one to ten birds each day depending on local abundance. Ten birds would be a very good day. A trapper could easily transport 30 or 40 birds by bicycle if he was able to trap as much. While *Oryzoborus* prices are lower than many species of the parrots, their prices compared to the cost of trapping and transporting them are actually much higher. According to experienced trappers, a serious trapper can trap 100 - 150 birds in a season. The main trapping season is during the dry season from August to December when there are plenty of the juvenile birds. Assuming there are 200 serious trappers in the Rupununi, this would add up to 20,000 to 30,000 birds every year. This does not include the birds trapped out of season, or by part time trappers such as the kids that are trapping around Annai and selling to the trucks heading for Georgetown. It is striking to see a volume that is similar or greater than the total number of parrots leaving Guyana every year, even when you incorporate estimates of illegal exports.

The spatial pattern in trapping pressure and population decline has spread from the most accessible areas around Georgetown to some of the most remote areas in the country. Although the trade is relatively new in the Rupununi, trappers report that the most accessible areas to Lethem and Annai have already been greatly reduced.

The finch trade not only demonstrates that the trade becomes more selective the farther the trapping area is from the market, it also provides an historical perspective to how this pattern can be important in an over-exploitation scenario. Historically, the trade in *Oryzoborus angolensis* was concentrated around the capitol, and in the patches of appropriate habitat that were closest to the Georgetown. Although there were trappers trapping *Oryzoborus crassirostris* in the Rupununi since at least the 1970's, the trade did not target *Oryzoborus angolensis* until the late 1980's. Now, the harvesting pressure is concentrated on the Rupununi, but the wild populations in the areas near Georgetown are still being trapped and are unlikely to recover as long as this species has a high market value.

Chapter 6: Implications for Research and Policy in the Wild Bird Trade

The data available on spatial patterns in harvesting pressure in Guyana's wild bird trade is consistent with von Thunen's model of land use. In theory, this conclusion and its implications are very straightforward. In reality, where space is heterogeneous and where actors make decisions at different spatial scales, understanding the implications becomes quite complex. This thesis demonstrates how research can start to untangle the relationship between market forces and spatial patterns in wild bird harvesting pressure. Research on the economics of the bird trade could be a valuable tool for making realistic predictions on how the trade will impact wild populations in the future, as well as aiding policy makers charged with monitoring and regulating the trade.

6.1 Research on Harvesting Pressure

This research demonstrates that there are at least three variables that should be taken into account when attempting to model spatial patterns in harvesting pressure in the wild bird trade. These are the cost of transportation, bird abundance, and human population density. All three variables can be critical to the overall cost of production in the trade, and all three factors must be incorporated to create a realistic spatial model of harvesting pressure. There are two kinds of questions that need to be addressed by further research. First, how does harvesting pressure change in relation to these three variables. Second, how do these three variables change over space?

Transportation costs almost always increase with distance from market, but this relationship is not straightforward because transportation options vary greatly at both the local and the national scale. At the local scale, the cost of transportation depends on the number of birds being shipped and the availability of transportation. In some cases, particularly in agricultural areas, the cost can be greatly reduced by bundling goods together. In more remote areas there are fewer options, and trappers can be forced to rely on more expensive transportation. At the national scale birds are shipped to Georgetown by car, truck, speedboat, ferry, and by plane. As a rule, the means of transportation becomes more costly the farther from market. The big exception is the government-run ferry that transports goods between the northwest and Georgetown. As a result, the cost of transporting birds from the northwest is cheaper than in some areas that are closer to the capital.

In addition to the cost of transporting birds, there are other costs that are associated with transporting birds from certain locations. For the trapper, accessing more remote areas requires an extended trip that is more capital intensive. For the trader, in addition to transporting birds, he must make trips to oversee his shipments, or at least to maintain his business relationships.

Bird abundance is important because the cost of trapping increases when bird abundance decreases. Often, actors in the trade face a trade off between bird abundance and the cost of transportation. Some trappers trap a few birds around the house, often low value species. Other trappers go on extended trips to areas that are rich in high value species. The trader faces a similar trade off. For example, one trader reported that he can only buy 30 or 40 *Oryzoborus angolensis* on a trip to areas near the east coast, but he could buy a couple hundred birds on each trip to the Rupununi. Even though the cost of transportation for him and the birds is higher from the Rupununi, the cost per bird is actually lower.

Human population density is a third factor that needs to be taken into account because there need to be enough trappers to trap birds. Although this factor was not originally considered in this project, it quickly became clear in Guyana that bird abundance and the cost of transportation combined still do not explain the overall patterns in harvesting pressure. The Kamarang area has healthy populations of a number of high value species including *Amazona dufresniana, Deroptyus accipitrinus*, and *Oryzoborus angolensis*, and the shipping costs are lower than in Lethem, but there is almost no trade. The reason appears to be that there are not enough trappers. Part of the problem may be that the area has a lot of mining operations that employ potential trappers, but the biggest problem is that overall population density is much lower than either the Rupununi or the Northwest. Human population density can be a limiting factor, but it is not clear what the relationship with harvesting pressure is beyond that.

These three variables help explain why the northwest region in Guyana is ideal for the bird trade, at least with parrots. The cost of transportation is very low because the region is already set up to ship agricultural products to Georgetown, and the ferry plays a key role in this infrastructure. The northwest has abundant populations of wild parrots, including many high value species, and the region has a healthy human population compared to other areas in the interior. However, this region may not always be the primary source of parrots for Guyana. One species, *Ara ararauna*, is becoming rarer, and more expensive, at least according to traders who work in the region. If this and other high value species become more difficult to find, the region's trade may become less profitable. A second reason may prove to be an even greater threat to the trade. The northwest ferry is not profitable, and it only runs because the government subsidizes it. If the government decided to stop the ferry service, it could have a profound impact on the spatial pattern in harvesting pressure for parrots in Guyana.

6.2 Monitoring and regulating the wild bird trade

If authorities want to protect wild populations from overexploitation they need to be able to detect unsustainable trade, and they need to have tools to influence the trade. In other words, conservation in the context of the bird trade depends on monitoring and regulation. This is true for both the legal and the illegal trade.

In Guyana, the wildlife division monitors how many birds are being exported legally, but it does not monitor the trade within the country. This type of trade monitoring would not detect significant overexploitation in a given species as long as there is a steady flow of birds being exported. Even if exports dwindled, this could easily be explained by a drop in demand. However, if the wildlife division monitored the trade within Guyana, it would be able to detect changes in the trade that indicate regional overexploitation. At the least, it could help prioritize the scarce resources available for surveys of wild populations.

Oryzoborus angolensis is an example of a species that might have benefited from such a monitoring regime. Over the last 15 years the volume of trade in this species decreased from the areas near the east coast, increased from the Rupununi, and the market value increased. This could not be explained by the cost of transportation, because the Rupununi is much more expensive. There was not a big change in population density in either region. This information alone should justify field work on these wild populations. Another example might be with the large macaws for which harvesting intensity has also shifted from the coastal areas to the Rupununi.

In Guyana, a monitoring regime could easily be set up based on the current system of checkpoints already set up at Ogle Airfield in Georgetown, at the ferry landing in Georgetown, and the Mabura Hill police checkpoint in the interior. These checkpoints alone would go a long way toward documenting trends in harvesting pressure for different species. Unfortunately, the data that is currently being recorded at these checkpoints does not make it to the wildlife division. This data would be cost effective to collect, and a valuable resource for prioritizing wild population monitoring efforts. This is critical in the case of Guyana and other countries that have limited resources for carrying out field surveys.

Currently the spatial pattern in harvesting pressure is a result of market forces, and it is not clear what tools for intervention are available to the authorities in Guyana. Implicit in any intervention is the question of what the optimal harvesting regime would be. One exporter said he thought there should be regional quotas to spread out harvesting pressure. Another exporter said that it was good that harvesting pressure is concentrated because the unharvested populations replenish the harvested populations. Of course, the optimal harvesting regime will depend on the species involved. Regardless, considering that Guyana has a weak enforcement presence in the interior, it would be a significant achievement to detect and prevent unsustainable trade within one region in Guyana.

Appendix A: Background on CITES and Trade Regulation in Guyana

By far, the most important source of regulation on the wild bird trade is the Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES). CITES was a product of the general public alarm concerning the threat of wildlife overexploitation in the 1960s. CITES was signed in 1973 by 80 parties, and came into force on July 1st, 1975. Currently there are over 160 member parties (Figure A1).

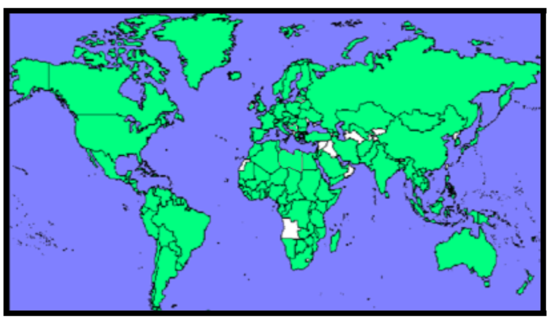

Figure A1: Map of CITES member parties (in green)

In some countries, like Guyana, CITES is the primary component of the countries wildlife trade policy. In other cases, like in the United States, countries have instituted stricter regulation that is based on the CITES framework. In addition to having a global mandate, CITES covers an impressive 33,000 species of plants and animals. This includes 1,696 species of birds, close to one sixth of all bird species on Earth. Despite the impressive geographic and species coverage, much of the wild bird trade is either insufficiently or not at all covered by CITES.

According to the Secretary-General of CITES, the title of the convention "gives the wrong impression that it only concerns trade in endangered species" (Wijnstekers and Secretariat of the Convention on International Trade in Endangered Species of Wild Fauna and Flora 2001). This misconception is reinforced by the publicity that high profile Appendix I species receive. However, Appendix II is arguably the most important Appendix in CITES. Appendix I includes 827 species, compared to the 32,540 species on Appendix II. With birds, there are 146 species on Appendix I, and 1401 species on Appendix II. Approximately 85% of the parrot family (Psittacidae) is on Appendix II. Unfortunately, there is a widespread consensus that Appendix II is failing in its present form (Jenkins 2000).

Both the strengths and the weaknesses of Appendix II regulation are a direct result of how the convention is implemented. CITES depends on the preexisting network of customs agents found at international boundaries around the world. This is very practical. Every time a species on Appendix II is exported, it must be issued an export permit. To monitor the trade, CITES records how many permits are issued for each species in each country. The most common trade intervention is the national quota, which limits how many export permits can be issued per species per year. The national quota is supposed to be set by the exporting country at a level that will prevent unsustainable harvesting. However, this framework is only as good as the legislative, administrative, and technical capacity of the exporting country. A major weakness is the ability of many exporting countries to carry out costly and technical field surveys on wild populations. One solution to this problem is to develop cost effective methods for monitoring the trade within the exporting country and its impact on wild populations.

There have been two important consequences of the failure in Appendix II regulation. One is that Appendix II species are exported at unsustainable levels. The second is that importing parties have responded by passing stricter regulation on top of CITES. The Wild Bird Conservation Act (WBCA), passed in 1992, effectively bans the importation of wild caught Appendix II birds into the United States. There is also a movement in the European Union to ban the importation of all wild caught birds. The WBCA has proven that importation bans can reduce the pressure of both the legal and illegal trade on wild populations (Wright et al. 2001), but it has also been criticized for undermining the effectiveness of the CITES framework (Hutton J.M. 2000).

In response to the weaknesses in Appendix II, the member parties developed a review process to provide accountability. The "Significant Trade" process was formalized by CITES Resolution Conf 8.9 in 1992, the same year the WBCA went into force. The latest revision of the process, CITES Resolution Conf 12.8, was passed during the conference of parties in Chile during 2002. This process starts by identifying species that are being traded at potentially unsustainable levels. A detailed review of information on that species is then compiled and circulated with range states for comment and updating. Then it is sent to the CITES Animal Committee, which determines if paragraphs 2-a and 3 of Article IV are being satisfied.

Paragraphs 2-a and 3 of Article IV state:

> 2. The export of any specimen of a species included in Appendix II shall require the prior grant and presentation of an export permit. An export permit shall only be granted when the following conditions have been met:
>
> (a) a Scientific Authority of the State of export has advised that such export will not be detrimental to the survival of that species;

> 3. A Scientific Authority in each Party shall monitor both the export permits granted by that State for specimens of species included in Appendix II and the actual exports of such specimens. Whenever a Scientific Authority determines that the export of specimens of any such species should be limited in order to maintain that species throughout its range at a level consistent with its role in the ecosystems in which it occurs and well above the level at which that species might become eligible for inclusion in Appendix I, the Scientific Authority shall advise the appropriate Management Authority of suitable measures to be taken to limit the grant of export permits for specimens of that species.

If it is determined that this article is not being satisfied, then the committee makes recommendations for the exporting country in question. The exporting country then has 90 days to address the recommendations to the satisfaction of the CITES Secretariat. If the country does not respond to the recommendations, then the Secretariat has the option of recommending a ban, which gives the process teeth. The success of the "Significant Trade" process depends on both the quality of the recommendations, and the ability to carry them out.

Guyana is a good case study of the influence of CITES in the regulation of the wild bird trade. For most of the 1900's, the only legislation offering protection for birds was the Wild Birds Protection Act of 1919. However, this legislation was limited in scope, the fines were minimal, and it did not provide much protection.

In 1977, Guyana ratified CITES, but it did not have the necessary laws to implement its obligations as mandated by the treaty. Almost all of the species of birds exported from Guyana are listed on Appendix II. If a country does not fulfill its obligations under the treaty, then the country can be reported by other member countries, and warned by the CITES Secretariat. If the Country does not remedy the problem, then the Standing Committee can recommend that CITES parties not trade listed species with the country. International pressure and CITES has shut down Guyana’s wild bird trade on four occasions in the last twenty years. The first moratorium was in 1987 when CITES deemed that Guyana still did not have sufficient laws to fulfill its obligations under the treaty. This moratorium was lifted when Guyana drafted new legislation, established closed seasons, and set new export quotas. The second moratorium shut down the trade in 1993 because there was significant international concern that Guyana’s levels of export were detrimental to wild populations. In response, the quotas were revised again, and the moratorium was lifted in 1995. Since 1995 the trade has been shut down temporarily two more times, again under international pressure.

In an attempt to improve regulation of the wildlife trade Guyana passed the Environmental Protection Act of 1996, and the Species Protection Regulations of September 1999. These acts strengthened regulation, especially in regards to penalties and quotas. However, a number of serious inadequacies still exist in regards to the wild bird trade, especially in regards to enforcement and monitoring.

The enforcement of the international trade is dependent on customs officers and the domestic trade in general is neglected (Hoefnagel, 2001). The enforcement problem is compounded by corruption that has dogged Guyana’s regulatory agencies. For example, in 2004, the head of the Wildlife Division was forced out due to charges of accounting irregularities and illegal exports (Johann Earle, 2005, 2004, Stabroek News, 2004). In a review of wildlife trade legislation in the Guianas, Hoefnagel (2001) suggests that Guyana needs to adopt a more local or community based approach to enforcement.

Insufficient data on wild populations is a problem in Guyana and there have been many calls for action (Singh, 1994, Richards 2000, Hoefnagel, 2001, Duplaix, 2001).

However, only one survey has actually been conducted, and it was limited to about two months in 1997, and only covered parrots (Kratter 1998). By in large the quotas have been set based on past export figures, and not on any data on wild populations. Hoefnagel (2001) suggests:

> …population surveys should be target driven and carried out within a management and social framework. First, a better understanding of the relations between people and wildlife must be acquired prior to embarking on surveys which at best can be costly and labor intensive.

In Guyana, wildlife trade enforcement and population surveys have suffered from limitations in resources and technical capabilities. Efforts need to be prioritized in a way to maximize their benefits. Monitoring the trade within Guyana would provide crucial information that would help focus efforts on the actors and areas that need the most attention. However, currently there is not a monitoring regime that collects information on the wild bird trade within Guyana.

Appendix B: The Parrot and Toucan Trade by Region

According to both traders and exporters, the Northwest is less important than it used to be, but it still supplies at least 60% of the parrot trade. About a quarter of this trade is taken to Charity by boat, and then by vehicle to Georgetown. The rest go through Mabaruma, and are transported to Georgetown by ferry or plane. The ferry log documents the number of parrots and toucans each trip, a dataset documenting the volume and temporal pattern of the Northwest's trade.

Below are two tables with the results of a survey of the ferry load on 13 July, 2003, and ferry records for 2001 through 2003 (Tables B1 and B2). The export data for Guyana and Suriname are based on CITES records. These estimates have three sources of error that should be considered. The first can produce overestimates in the volume of high value species. Because middlemen get the majority of their profit from high value species, they focus on those until the market is saturated, or the less likely situation where the quota is filled. As a result, high value species make up a higher percentage of the ferry load than later in the season. The estimates probably overestimate high value species and underestimate low value species. The second source of error is specific to delicate species. According to exporters and traders, Traders often ship toucans, *Deroptyus accipitrinus*, and *Pionus fuscus* by air. The ferry records probably underestimate the number of these birds coming from the Mabaruma area. The third source of error deals with the official CITES export records for Guyana and Suriname in 2003. The official number may still go up as more records are reported to CITES. The CITES database was accessed in April 2005. For Guyana, CITES reports 9,437 parrot and toucan exports for 2003, which is 54% of the previous four years, and 76% of the previous year. For Suriname, CITES reports 7,135 parrot and toucan exports for 2003, which is 68% of the previous four years, and 70% of the previous year.

Year	**2001**	**2002**	**2003**
Recorded ferry load for the year	6930	4344	4914
Projected ferry load for the year	19404	12163	13759
Official Guyana exports (CITES)	21196	12444	9437
Recorded % of legal exports	33%	35%	52%
Projected % of legal exports	92%	98%	146%
Official Suriname exports (CITES)	8778	10336	7135
Total exports for Guyana and Suriname	29974	22780	16572
Recorded as % of Combined Exports	23%	19%	30%
Projected as % of Combined Exports	65%	53%	83%

Table B1: The Mabaruma ferry load. Percentages based on the volume of all parrot and toucan species exported from Guyana and Suriname. Total official exports for 2003 are likely to go up as more are reported to CITES.

Name	Trapper price at ferry	14 July 03 ferry	2003 Exports	2003 Quotas	Projected 2003 ferry total	Projected % of exports	Projected % of quota
Amazona farinosa	$8.38 (Charity)	360	637	1100	3879	609%	353%
Amazona dufresniana	$20.95	110	300	520	1185	395%	228%
Pionites melanocephala	$1.68	60	364	600	647	178%	108%
Ramphastos vitellinus	$5.59	5	38	120	54	142%	45%
Ramphastos tucanus	$8.38	5	47	170	54	115%	32%
Amazona amazonica	$1.12	350	3867	9900	3772	98%	38%
Pionus fuscus	No Data	16	178	780	172	97%	22%
Amazona ochrocephala	$9.76	50	604	1000	539	89%	54%
Ara ararauna	$25.14	66	878	792	711	81%	90%
Ara chloroptera	$30.73	63	869	990	679	78%	69%
Amazona festiva	No Data	10	278	520	108	39%	21%
Deroptyus accipitrinus	$25.14	10	359	780	108	30%	14%
Pionus menstruus	No Data	0	381	900	0	0%	0%
Ramphastos toco	$180 (Charity)	0	41	200	0	0%	0%
Unidentified amazons		180			1940		
Total		1285	8841	18372	13848	157%	75%

Table B2: Ferry load for 14 July 2003, and projected total for season. According to ferry records, this load was 9.3% of the ferries load for the year. Percentages based on species listed. 2003 exports are likely to go up as more are reported to CITES.

The projections in the previous two tables are based on the assumption that the ferry load is systematically under recorded. The ferry load is recorded at the ferry landing when the ferry arrives in Georgetown. Personnel working at the landing, not on the ferry, record the number of birds because they charge traders by the dozen. During the ferry trip that landed on July 14^{th} 2003, the author recorded 1,285 parrots and toucans. The ferry landing recorded 38 dozen, or 456 birds. This means the ferry landing estimated 35% of the volume on the ferry. The assumption that the ferry load is systematically underestimated is based on a number of factors. First, it is extremely difficult to count the number of birds in a cage. Most often the birds are moving around in what seems to be an uncountable green mass (Figure B1). The author had the benefit of counting the birds after they had been fed and covered; the birds were resting and not moving around nearly as much. Previously, when the birds were not resting, the author grossly underestimated the number of birds in each cage. Second, according to employees of the ferry landing, the number of birds are estimated in the same way each trip. Third, personnel that worked on that ferry reported that the July 14^{th} load was a normal load, and the load was often larger. According to the ferry records, the average ferry load was about 27 dozen birds, or 324 birds.

Figure B1: Parrot cages on the ferry. Each cage can transport over 100 birds.

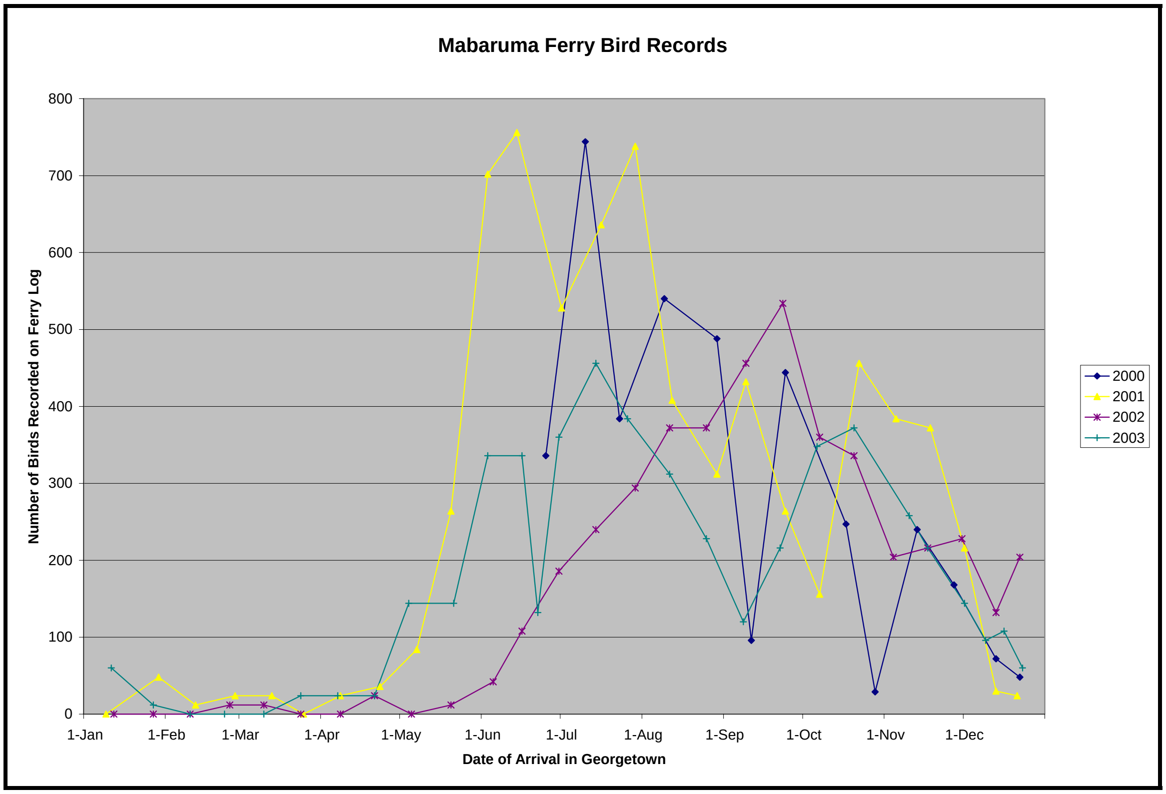

Figure B2: Seasonal change in the volume of birds on the ferry. This chart documents the annual pattern in the recorded volume of parrots and toucans being transported to Georgetown on the Mabaruma ferry. These numbers do not include songbirds, which are not recorded on the ferry log. Note: the legal export trade was shut down from December 2001 to mid June 2002.

The ferry log is the only documentation of temporal patterns in the trade over the course of the year (Figure B2). The trade is reduced to a few dozen when the season is closed from January through April. This suggests that the trapping season is obeyed by most but not all of the participants in the parrot and toucan trade. In addition, this data documents the impact of a trade ban. All exports were banned from December 2001 to June 2002. When the trade was banned in December 2001 the volume of birds on the ferry dropped to the lowest level recorded for December in the four years of data. When the trade was opened again in mid June 2002, it took much longer for the trade to build up than in other years, and the season peaked much later than usual.

This data illustrates that even within the trapping season there is a temporal pattern to trade. In most years the trade peaks early in the season and then trails off. This may reflect that the market for certain species becomes saturated. The changes in the volume of trade highlight the importance of communication between the trapper and the trader. Even during the trapping season the trapper takes a risk by investing time into trapping if he does not know if he can sell the birds. The temporal pattern within the season also demonstrates the difficulty with measuring the volume of birds in the trade at one point in the year and extrapolating for the rest of the year.

The Rupununi trade consists mainly of a few high value species. Exporters claim that the Rupununi only provides about 10% of the birds in the trade. The species that are commonly exported from the Rupununi include *Ramphastos toco, Ara ararauna, Ara chloropterus, Deroptyus accipitrinus, and Amazona ochrocephala*. *Ramphastos toco* is the most valuable species, and the Rupununi appears to be the main supplier in the country. In 2002 the Rupununi supplied almost all of the 145 *R. toco* that were exported from Guyana with one trader alone supplying 70. Collectively the traders in Lethem supply a few hundred of both *Ara ararauna* and *Ara chloropterus* each year. If all of these are exported from Guyana, then the Rupununi would be responsible for a third to half of the Macaws exported from the country. Traders reported shipping less than 100 *Deroptyus accipitrinus* in 2002, which would be significant, but still less than a third of the total trade. *Amazona ochrocephala* is the least valuable species in the Lethem trade, and in the words of one trader, “almost not worth the effort”. However, they still claimed to have bought over 300 of them in the last year which would be over a third of the country's legal exports.

The East Coast includes the coastal area stretching from Georgetown to the border with Suriname. This area is the most accessible and the most heavily populated area in Guyana. According to exporters and traders birds are trapped on each of the coastal river systems from the Demarara to the Courantyne. According to exporters this region makes up approximately 30% of the parrot and toucan trade. One species of special interest is the *Ara macao*, which is a CITES Appendix I species. This species has a zero quota in Guyana, and Suriname only has a quota of 100 per year. Despite this, trappers on the Courantyne reported selling about 200 every trapping season. Many of these birds were observed directly. One of the trappers reported that he sells his *Ara macao* to a buyer on the coast who happens to also be a customs agent.

Appendix C: Species Prices and Official Quota for 2003

Latin Name	Official Export Quota	Official Export Value	Trader Price	Trapper Price
Amazona amazonica	9900	$32	$5	$3
Ara manilata	1650	$65	no data	$3
Amazona farinosa	1100	$72	$11	$6
Diopsittaca nobilis	1100	$50	no data	$4
Amazona ochrocephala	1000	$86	$22	$10
Sporophila minuta	1000	$11	$3	$1
Sporophila lineola	1000	$11	$2	no data
Ara chloropterus	990	$288	$45	$25
Pionus menstruus	900	$36	no data	$1
Ara ararauna	792	$252	$45	$24
Deroptyus accipitrinus	780	$360	$45	$27
Pionus fuscus	780	$86	no data	no data
Forpus passerinus	600	$22	no data	$3
Pionites melanocephala	600	$50	no data	$2
Amazona festiva	520	$86	$45	no data
Amazona dufresniana	520	$216	$42	$22
Aratinga pertinax	500	$14	no data	no data
Oryzoborus crassirostris	300	$11	$22	$11
Oryzoborus angolensis	300	$11	$12	$6
Pyrrhura picta	300	$101	no data	no data
Aratinga leucophthalmus	300	$72	no data	no data
Pteroglossus aracari	300	$65	no data	no data
Selenidera culik	260	$260	no data	no data
Ramphastos toco	200	$144	$321	$130
Brotogeris chrysopterus	180	$22	no data	$3
Ramphastos tucanus	170	$115	$25	$8
Ramphastos vitellinus	120	$115	$25	$7
Pyrrhura egregia	120	$36	no data	no data
Psophia crepitans	90	$230	no data	no data
Crax alector	52	$180	no data	no data
Pteroglossus viridis	52	$65	no data	no data
Sporophila schistacea	0	no data	$22	$11
Sporophila bouvronides	0	no data	$2	no data
Ara macao	0	no data	no data	$17
Sporophila castaneiventris	0	no data	no data	$1

Table C1: Species Prices and Official Quota for 2003

Although this price changes considerably as the bird moves along the commodity chain, the relative values of different species remain consistent. Figure C1 shows that the price that a trapper sells a species for in the interior is highly correlated to the price a trader sells the same species for in Georgetown. Furthermore, Figures C2 and C3 show how both the price that the trapper sells for and the price that the trader sells for are highly correlated to the official price of birds being legally exported.

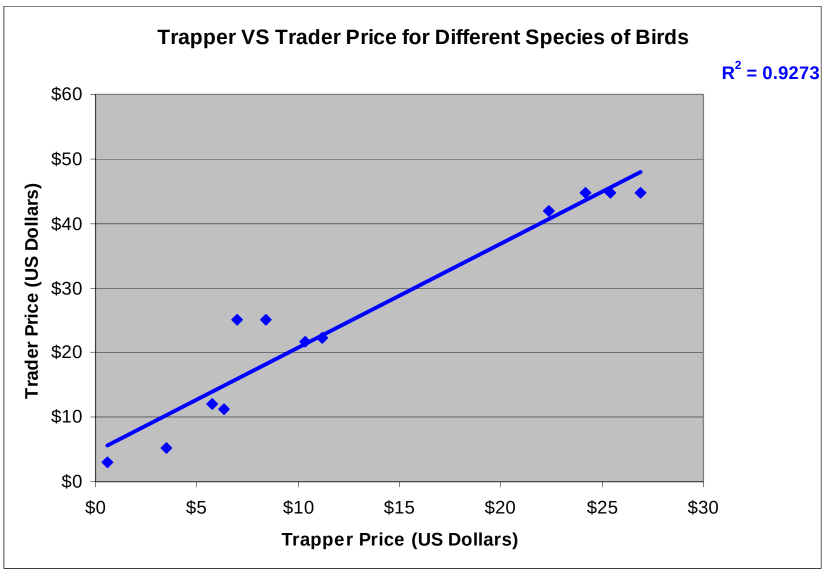

Figure C1: Trapper's price versus trader's price for 13 species of parrots, songbirds, and toucans with known values.

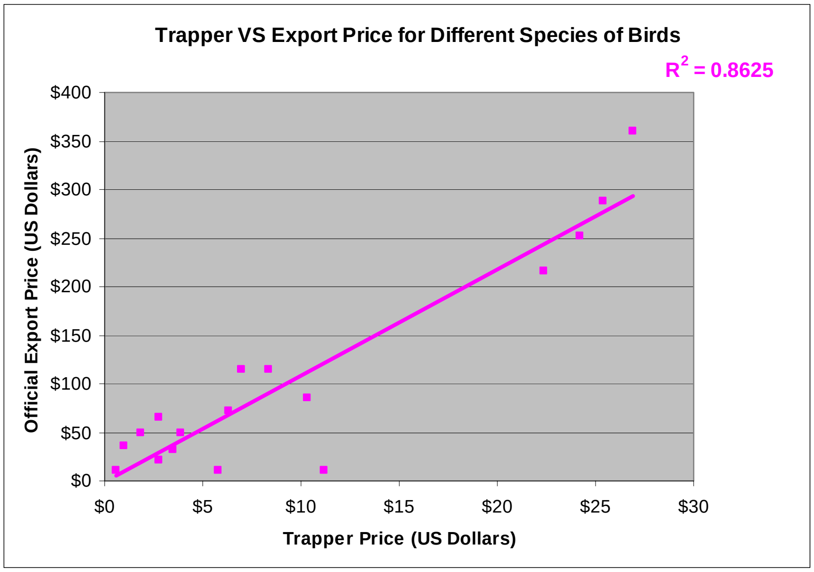

Figure C2: Trapper's price versus official export price for 20 species of parrots, songbirds, and toucans with known values.

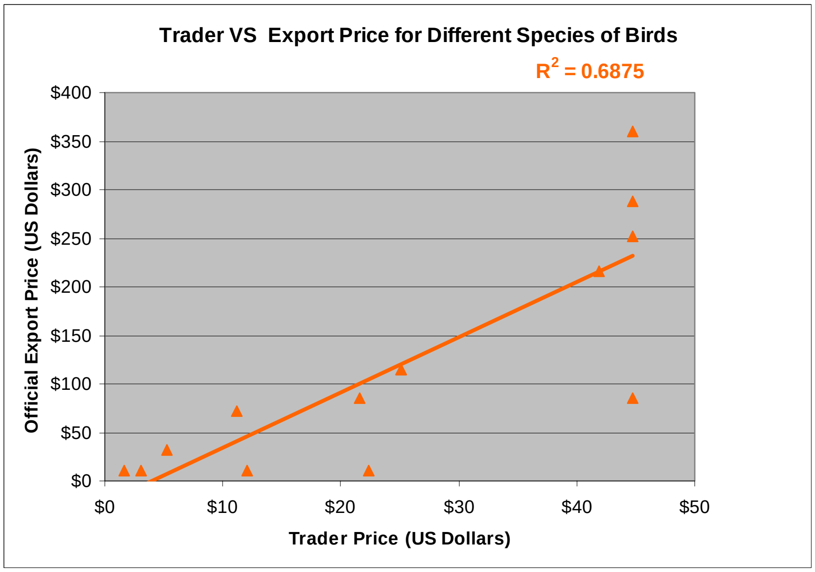

Figure C3: Trader's price versus official export price for 14 species of parrots, songbirds, and toucans with known values.

Appendix D: Trapping Techniques

Every parrot and toucan trapper interviewed used the same strategy for trapping birds, the “tree house method”. There are other strategies that are used, but this is by far the most common one in Guyana. The “tree house method” involves building a tree house, or “nest”, in a tree where the trapper hides and waits for parrots to land. In order to lure parrots to the tree, they bring a pet parrot, a “lure” or “calling bird”. When parrots are flying over the forest, they assume that a tree is safe when they see the “lure” in the tree. When the parrots land in the tree, the trapper catches the wild parrots and passes them down to another trapper. With this strategy, multiple birds can be caught in a single morning. Although this strategy is efficient, it also requires some time investment and can be dangerous. Alternative strategies, such as nest poaching, are far less common.

Palms, such as the Manicole palm (*Euterpe oleracea*), are the most common type of trees used for making a nest, or tree house. A tree is selected that stands above the canopy, or the surrounding vegetation. The three trapper “nests” observed were all at least 50 feet above the ground. The “nest” is situated in the center of the palm’s crown, and is made up of green fronds from the palm (Figure D1). It is just large enough for the trapper to sit inside. The trapper is completely hidden in the “nest”. All of the remaining fronds are cut off or bent down except for two. One frond is left for the calling bird, and the second is left as a perch for the wild birds. Palms are ideal for trapping because they are tall, and if a bird lands in the tree, they have to land close to the trapper. Trappers actually catch the bird through an assortment of methods including a lasso on a pole, a pre set snare, adhesive gum, or a seine net.

In some situations, the tree house method can be used on the ground, or with out the aid of a calling bird. Trappers reported that *Pionites melanocephala* can be trapped from the ground using a calling bird. According to traders, this is partly why this species is one of the cheapest species sold by trappers. The only time that this method was reported without the aid of a calling bird was with the *Ramphastos toco*. The trapper goes to an area where the toucan is found, and spends a day or more watching their habits. The trapper then builds a tree house at night where the toucans regularly perch. In this way, a trapper might catch one or two *Ramphastos toco* in a week.

The tree house is an investment that can only be used for a limited period of time, after which productivity goes down. According to trappers, this is because birds become aware of the trappers and avoid the tree. In addition, the foliage used to disguise the tree house starts to die, making it more apparent.

Figure D1: The trapper's "nest" or tree house: starting in the upper left and going clockwise: The Nest above the canopy, the trapper with a wrapped frond used to climb the palm, the trapper climbing the palm, and the Trapper entering the nest.

In the finch trade, the emphasis is often on singing males. The most common strategy used is to place a caged singing male in a wild male's territory. When the territorial male flies in to investigate the intruder, he is caught by an adhesive gum on a nearby perch. Alternatively, small traps are set alongside the intruder male's cage (see Figure D2). Another common strategy is to use mist nets, which are sold in Brazil for catching bats.

Figure D2: Finch Trapping tools. Robbie Robertson has trapped songbirds in the Rupununi for over 33 years. Left: Mr. Robertson with one of his mist nets. Right: A male *Oryzoborus angolensis* used to trap territorial males. Note the traps on either side.

Appendix E: Domestic Retailers and Finch Racing

There has not been a systematic survey of the retail in parrots and toucans, but according to exporters and traders it makes up less than ten percent of the parrot and toucan trade. The most popular avian pets in Guyana are finches of the genera *Oryzoborus* and *Sporophila*, *Oryzoborus angolensis* being the most popular by far.

Figure E1: A bird shop in Georgetown

During a survey of pet stores (Figure E1) in Georgetown, over a thousand finches, very few parrots, and no toucans were observed. The most common psittacid was *Melopstiiacus undulates*, which is native to Australia and are reportedly bred in Brazil. The only psittacids native to Guyana that were observed on sale in Georgetown included one *Aratinga solstitialis*, one *Amazona ochrocephala*, two *Brotogeris chrysopterus*, and two other unidentified *Aratinga* parakeets. However, trappers also told me that they would sell or give away birds that they could not sell to traders. Likewise, the domestic market may also be a way for exporters to get rid of excess stock when they cannot find a foreign market for a species.

Keeping songbirds as pets is a very popular hobby in Guyana. The focus in the finch trade is on the birds singing ability which they often test in competitions. These competitions, called races, are won by the first bird to sing fifty times (Figure E2). A race is bound by the owners putting money down as a wager. Often, outsiders will also bet with each other on the race. If a bird wins a series of races, especially if the races are for large bets, then the bird becomes worth more money. Some people make a living buying wild caught birds, and training them to be strong singers.

Figure E2: Oryzoborus angolensis race. The men in white shirts on either side are the judges

By far, *Oryzoborus angolensis* is the most popular species used in the singing competitions. Finch enthusiasts claim that *Oryzoborus crassirostris* used to be the most popular species, and that it still is amongst the older generation, but at some point

Oryzoborus angolensis became more popular. It is possible that as *Oryzoborus crassirostris* became rarer, *Oryzoborus angolensis* became more popular because they were more readily available. Currently, *O. crassirostris* is only found in the Southern Rupununi, and its absence from the coastal regions may be a result of the trade.

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Vita

Cullen Keaton Hanks was born in Houston, Texas on March 10, 1976, the son of Marel A. Hanks and Stephen W. Hanks. From an early age he had an enthusiasm for natural history which was encouraged by his parents and his participation in several Victor Emanuel Nature Tours birding camps. After graduating from high school at The Kinkaid School, Houston, Texas, in 1994, he spent one year at Colorado State University where he majored in Wildlife Biology. In 1995 he transferred to Cornell University where he completed his Bachelors of Arts while majoring in biology. After graduating in 1998, he spent four years working on ornithology and conservation projects in Texas and Central and South America. In 2002, Cullen entered graduate school at the Lozano Long Institute of Latin American Studies at the University of Texas.

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