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STATUS, MANAGEMENT, AND TRADE OF PARROTS IN THE CO-OPERATIVE REPUBLIC OF GUYANA

by

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to

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and

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in accompanying species accounts, that also review the species' status in nearby countries, and their history of exportation from Guyana.

5. Many parrot species in Guyana show seasonal movements. Several species show a common pattern of retreating to the hillier interior forests during a January to May breeding season, but spreading into coastal flooded forests from June to September or later. It is during this latter season that most parrots in Guyana are trapped.

6. The survey results were analyzed to produce population densities. The densities were then used to calculate population sizes. A conservative methodology (one percent of the lower 95 % confidence interval for population size estimation) was then used to calculate quota levels for the export of parrots from Guyana; new quota levels could be no more than 10 percent above current quotas. Increased quotas were recommended for 13 species. Small quotas were also recommended for two species with current zero quotas (Dusky Parrot and Blue-checked Parrot). These rises in quotas have the potential to bring an additional US$ 188,000 annually to Guyana. Taxes from this increase are recommended to pay for a monitoring program to biannually assess the status of Guyana's parrot populations.

7. Additional recommendations made in this report are:
   1. to analyze harvesting levels at a regional level within Guyana.
   2. for the Ministry of Agriculture to determine how money in the Wildlife Fund is disbursed, and, if needed, draw up new regulations so that the money goes toward conservation of wildlife.
   3. for all people in the wildlife trade to promote that Guyana develop a system of protected areas.
   4. for the Ministry of Agriculture and CITES to coordinate the opening of export markets in Guyana and Surinam, to help stem the illegal flow of parrots to Surinam. In addition, the Wildlife Service Division should be punctual about opening up the export season.
   5. for the office of the Wildlife Services Division to prepare to apply for exporting wild-caught parrots and possibly captive-bred parrots to the United States under the Wild Bird Conservation Act of 1992.
   6. to encourage the development of captive breeding programs by the exporters. Parrots raised in captive breeding facilities should not be included in the export quotas recommended for wild-caught parrots.
   7. to develop a country-wide conservation education program that emphasizes parrots.
   8. to encourage the further education of trappers and middlemen in the proper maintenance and care of trapped parrots.
   9. to add a member that represents the middlemen or trapping communities to the Wildlife Advisory Committee .
   10. to not add to the number of current export licenses without a concomitant increase in quotas.

INTRODUCTION

The Cooperative Republic of Guyana is a small South American country on the northeastern "shoulder" of the continent. The country borders Venezuela to the west, Surinam to the east, and Brazil to the south. A 430-km coastline on the Atlantic Ocean forms the northern border (Figure 1). Although small (ca. 215,000 km^2, a bit smaller than the island of Great Britain), Guyana has an extremely rich biota found in a variety of tropical ecosystems. Ninety percent of the human population (ca. 765,000) is found in a narrow strip (ca. 15-60 km wide) of settlement along the coast (ca. 4% of the area), so the vast interior regions of Guyana have a low human population density. As a result, the native vegetation of Guyana - mainly tropical forests and savannas - still covers a large proportion of the country, and Guyana is not currently facing the extreme deforestation and other environmental disasters plaguing other tropical countries.

Guyana is one of the few South American countries still legally exporting wildlife for the pet and zoo trades in North America, Europe, and Asia (hereafter referred to as "the wildlife trade"). Because of Guyana's largely pristine natural environment, many wildlife populations in Guyana are probably of sufficient size to allow some degree of carefully monitored harvesting for this trade, as long as harvesting is done in a manner that sustains populations at their current levels.

Psittacines (macaws, parrots, parakeets, parrotlets, and amazons; hereafter referred to collectively as "parrots") form the most important part of the wildlife trade in Guyana (Figure 2), making up, in potential annual income, about 67 percent of the trade. The total annual income from parrots is potentially US$ 1,1470,000, if the entire quota for each species is sold. Other animals exported from Guyana include other birds (cracids, trumpeters, and toucans), various reptiles (snakes, lizards, and turtles), various frogs, and a wide assortment of mammals, including two primate species. Caimans, which may be ranched, and tropical fish are sold under separate licenses. The recent history of the export trade in parrots has been chaotic and controversial as international bodies and the Guyana government have wrestled with how to monitor the trade. There have been charges of over-exploitation and rampant illegal importation from Venezuela (see Schouten 1989, Desenne and Strahl 1991).

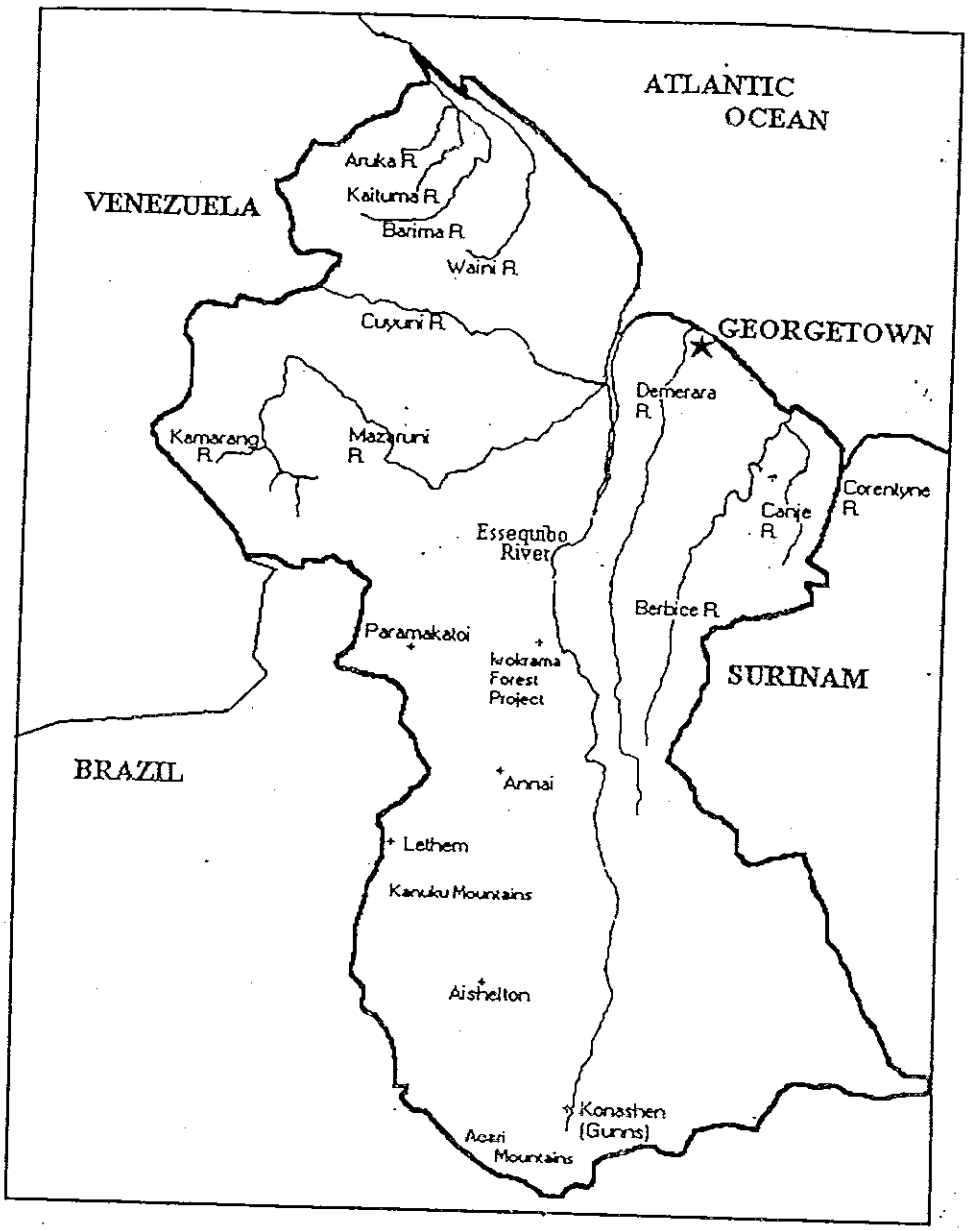


Figure 1. Map of Guyana showing major localities mentioned in the text.

Table 1. The 28 species of parrots known to have occurred in Guyana. The accepted English and scientific names are given (both from Sibley and Monroe 1994, although I use Hawk-headed Parrot and not Red-fan Parrot for *Deroptyus accipitrinus* because this species is commonly known by the former name in most literature dealing with the wildlife trade); in addition, other names commonly used in Guyana or in the literature are given.

English name	Scientific name	Local Guyanese or other names
Blue-and-Yellow Macaw	*Ara ararauna*	Blue Macaw
Scarlet Macaw	*Ara macao*	Red Macaw
Red-and-Green Macaw	*Ara chloroptera*	Red Macaw, Green-winged Macaw
Red-bellied Macaw	*Ara manilata*	Ité Macaw
Chestnut-fronted Macaw	*Ara severa*	
Red-shouldered Macaw	*Ara nobilis*	Noble Macaw
White-eyed Parakeet	*Aratinga leucophthalmus*	White-eyed Conure
Sun Parakeet	*Aratinga solstitialis*	Sun Conure
Brown-throated Parakeet	*Aratinga pertinax*	Brown-throated Conure
Painted Parakeet	*Pyrrhura picta*	Painted Conure
Fiery-shouldered Parakeet	*Pyrrhura egregia*	Fiery-shouldered Conure
Green-rumped Parrotlet	*Forpus passerinus*	Lovebird
Dusky-billed Parrotlet	*Forpus sclateri*	
Golden-winged Parakeet	*Brotogeris chrysopterus*	Lovebird
Tepui Parrotlet	*Nanopsittaca panychlora*	Roraima Parrotlet
Lilac-tailed Parrotlet	*Touit batavica*	Lovebird, Seven-colored Parrotlet
Sapphire-rumped Parrotlet	*Touit purpurata*	
Scarlet-shouldered Parrotlet	*Touit huetii*	
Black-headed Parrot	*Pionites melanocephala*	Black-headed Caique, Dee Cee, Seven-Colored Parrot
Caica Parrot	*Pionopsitta caica*	
Blue-headed Parrot	*Pionus menstruus*	
Dusky Parrot	*Pionus fuscus*	
Blue-cheeked Parrot	*Amazona dufresniana*	Blue-cheeked Amazon, Kwan-Kwan
Festive Parrot	*Amazona festiva*	Festive Amazon
Yellow-crowned Parrot	*Amazona ochrocephala*	Yellow-crowned Amazon,
Yellow-headed Parrot, Amazon Orange-winged Parrot	*Amazona amazonica*	Orange-winged Amazon , Cree-cha
Mealy Parrot	*Amazona farinosa*	White-eyed Parrot, Mealy Amazon, Sarama
Hawk-headed Parrot	*Deroptyus accipitrinus*	Red-fan Parrot.

HISTORY OF TRADE OF PARROTS IN GUYANA

Although the wildlife trade appears to have had a long history in Guyana, no records are available from before 1978, when Guyana started keeping records of the wildlife trade (permits and ledgers). Niles (1982) gave export records from 1978-79. In 1981 CITES started keeping records of exported parrots. A compilation of export data covering the years 1981-1986 was produced in 1987, and from these figures Guyana calculated a set of export quotas.

Guyana has officially licensed exporters since the early 1970's. A more formal licensing system was imposed in 1995. The license that permits the export of parrots also allows export of several other taxa, including various reptiles and amphibian species (but not caiman skins), various mammal species including two monkey species, several non-parrot bird species, and a few arthropods (tarantulas and morpho butterflies). Separate licenses are issued for exporting caiman skins, fish and captive-bred mammals or reptiles. There are currently 22 people in Guyana licensed to export parrots; an additional four may be licensed in 1997, but there are no plans to increase the number beyond this without a concomitant increase in the quotas (K. Pilgrim, pers. comm.). The Wildlife Advisory Committee (see below) is planning to register trappers and middlemen but there are no plans to restrict their numbers (K. Pilgrim, pers. comm.).

In 1986, the Wildlife Services Division of the Ministry of Agriculture was established to control the export trade in wildlife. At this time the division was given a list of exportable species and the dollar values of each species (presumably the average price paid to exporters). The Ministry has since regularly revised and updated the list of species that may be exported, their values, and quotas as information is received (e.g., from exporters, importers, CITES, visiting scientists, etc.). The values are used to determine the taxes imposed on wildlife exports (currently 20% of the predetermined value). An additional 1.5 percent export duty is collected by the Customs and Excise Department. The taxes collected are placed in a "Wildlife Fund" that was established in 1974. Although the money is supposed to be used for wildlife conservation, the documentation that defines how the funds are to be spent cannot be found and there has been some reluctance to spend moneys in the fund (K. Pilgrim, pers. comm.). Through 1996, some moneys in the fund were used for general management of the Wildlife Services Division and in one year (1992) they helped fund a survey of caimans. It has been suggested that five percent be given to Amerindian communities.

The Ministry of Agriculture has imposed two Moratoria on the wildlife trade. From January to October 1987 a moratorium was imposed to draft more comprehensive legislation and regulations. A new set of quotas were initiated at this time. In 1992, the current government took office and felt it was necessary to review the trade, partly as a result of allegations by the international community that there were improprieties in the trade and that harvest levels were not

sustainable (e.g. Desenne and Strahl 1991,Beissinger and Bucher 1992a, Thomsen and Brautigam 1991). Thus the trade was closed from February 1993 to November 1995.

When records started being kept (1978), the export wildlife trade of parrots was apparently already well established. Modest numbers of exports were reported in 1978-79 (Table 2). At this time, the overall status of parrots in Guyana was termed "excellent," and the export trade "not detrimental to the populations, which are under no stress from this activity" (Niles 1982, p. 431). In the early 1980s, the export trade became much more intensive, and alarms about over-harvesting began to sound. Between 1981 and 1986, from 20,000 to 40,000 parrot exports were reported every year (Figure 3). Numbers in 1987 were low because of the moratorium (see above). After the imposition of quotas in 1987, export numbers of parrots were stable at about 20,000/year until the second moratorium from 1993-1995. A slight increase was noted in 1996, but the late opening of the market that year decreased demand of international markets (various informants, pers. comm.), and the total numbers exported did not approach the 16,556 allowable under current quotas (Table 2).

IMPORTANCE OF STUDY

There is a great national and international concern that harvesting birds from the wild for the wildlife trade has led to declines in Guyana's parrot populations (Desenne and Strahl 1991, Beissinger and Bucher 1992a, Thomsen and Brautigam 1991). In at least one case (the Sun Parakeet), there is fairly strong evidence that trapping in the past (although not for the Guyana's legal wildlife trade) caused a parrot species to be almost extirpated from Guyana (see species account below). Although there is no strong evidence for overall declines in parrot populations, neither is there evidence that these populations are stable. Because the wildlife trade does harvest birds from the wild, and in the face of other perhaps more serious threats (e.g., habitat destruction), there is a need to assess the current populations of parrots in Guyana and determine the impacts being imposed by the wildlife trade.

The wildlife trade in Guyana is just one of several factors that may be responsible for current of future declines in parrot populations. Foremost among these other sources of decline is habitat destruction. In Guyana, the prime causes of habitat destruction are timber operations, extractive mineral operations, and clearing for agricultural purposes. Recently, large concessions of forests in Guyana have been granted to multi-national logging operations (Strieker 1997), and the feasibility of placing large-scale oil palm plantations in the Guyana is being analyzed (Anonymous 1997). Both of these activities are being pursued by Malaysian business interests, which have been responsible for enormous habitat destruction in southeast Asia and Indonesia (Strieker 1997). Like most other countries at tropical

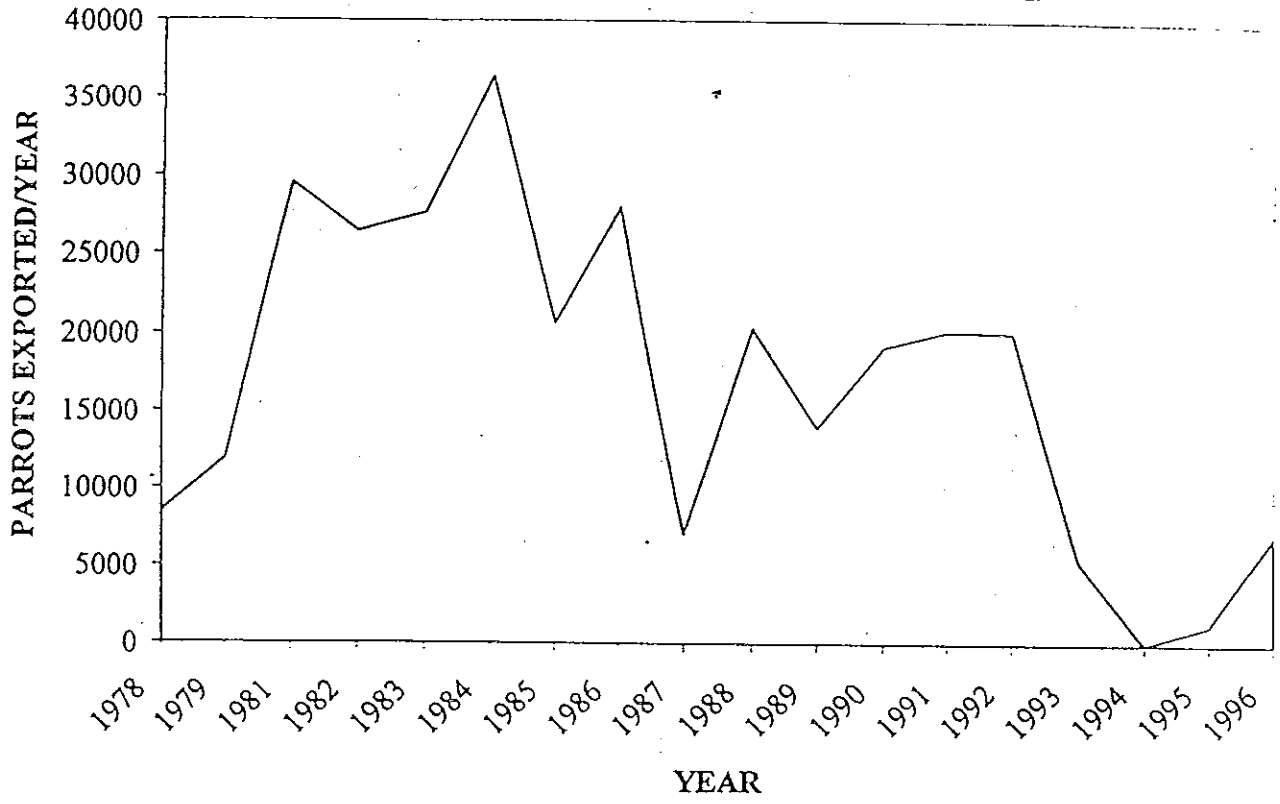


Figure 3. Number of parrots reported as exported from Guyana from 1978 - 1997. Numbers are from CITES records.

Table 2. Reported exports of parrots from Guyana, 1978 - 1979 (from Niles 1982) and 1981 - 1996 (from CITES records). *For 1989, CITES records list only imports originating from Guyana; ** for 1990, CITES records of imports from Guyana and exports reported by Guyana do not agree; the larger numbers are listed here; *** for 1993 - 95, a moratorium was placed on export of wildlife (see text).

species	78	79	81	82	83	84	85	86	87	88
Blue-and-Yellow Macaw	0	952	1312	706	1441	979	2555	3317	842	1768
Scarlet Macaw	0	0	2	1	8	53	132	0	0	0
Red-and-Green Macaw	114	181	1385	1146	992	1401	1335	2177	743	1460
Chestnut-fronted Macaw	0	0	0	0	0	0	8	0	0	0
Red-bellied Macaw	0	1	507	242	1043	962	350	824	264	1052
Red-shouldered Macaw	421	451	506	254	754	727	540	554	159	622
White-eyed Parakeet	326	464	2	25	22	0	0	0	0	8
Brown-throated Parakeet	1636	1560	1865	1785	1348	1627	491	422	92	505
Sun Parakeet	0	223	1362	694	342	39	39	22	0	0
Fiery-shouldered Parakeet	0	0	0	0	0	0	0	50	25	6
Painted Parakeet	0	5	249	92	55	28	10	15	2	7
Green-rumped Parrotlet	0	166	3	9	10	10	433	25	15	75
Golden-winged Parakeet	0	13	0	80	30	0	130	83	13	39
Black-headed Parrot	684	415	25	261	322	805	458	658	120	316
Dusky Parrot	149	4	5	8	58	277	96	250	68	120
Blue-headed Parrot	315	416	1102	498	1044	997	198	507	148	571
Blue-cheeked Parrot	437	0	2	2	112	64	133	103	38	81
Yellow-crowned Parrot	495	955	1763	1867	1935	2819	1769	3433	511	1280
Festive Parrot	0	0	0	0	17	2	13	555	54	133
Orange-winged Parrot	5317	8671	16745	16555	15555	21076	10545	12946	3519	10793
Mealy Parrot	2243	2306	2598	1832	2308	4171	1164	1537	348	1292
Hawk-headed Parrot	0	5	105	373	299	380	212	619	126	204
total	8492	11937	21213	20629	20226	28512	13836	19193	4596	13783

species	89*	90**	91	92	93	94	95	96	81-92 AVE.
Blue-and-Yellow Macaw	1637	1529	1689	1720	775	0	45	444	1625
Scarlet Macaw	0	0	0	0	0	0	0	0	16
Red-and-Green Macaw	1223	1238	1390	1484	469	0	56	680	1331
Chestnut-fronted Macaw	0	0	0	0	0	0	0	0	0
Red-bellied Macaw	484	650	923	769	260	0	72	189	673
Red-shouldered Macaw	395	940	865	823	277	0	77	137	595
White-eyed Parakeet	0	0	0	7	2	0	0	0	5
Brown-throated Parakeet	0	0	0	40	20	0	0	0	681
Sun Parakeet	0	30	0	67	0	0	0	0	216
Fiery-shouldered Parakeet	0	0	0	23	13	0	0	0	9
Painted Parakeet	0	30	23	90	73	0	0	0	50
Green-rumped Parrotlet	62	30	20	10	0	0	0	0	59
Golden-winged Parakeet	45	74	46	11	27	0	0	0	46
Black-headed Parrot	161	525	474	451	118	0	77	200	381
Dusky Parrot	174	270	237	203	50	0	0	0	147
Blue-headed Parrot	88	571	549	787	158	0	92	551	588
Blue-cheeked Parrot	2	0	0	0		0	0	0	45
Yellow-crowned Parrot	862	1441	1076	1753	309	0	108	367	1709
Festive Parrot	4	40	0	0		0	0	0	68
Orange-winged Parrot	7702	10105	11587	9968	2216	0	590	3903	12258
Mealy Parrot	978	1189	932	1485	519	0	60	499	1653
Hawk-headed Parrot	108	440	374	334	89	0	0	0	298
total	9656	13215	13969	13540	3133	0	758	4769	16031

latitude, Guyana does not have a strong economy, and sources of income, especially through foreign trade, are highly sought. Timber and mineral resources have great potential to bring quickly much-needed foreign capital into Guyana's economy; agriculture provides foods resources for Guyana's human population and has the capacity to provide capital from export markets. As a result, the government and citizens of Guyana (and other tropical countries) have often been willing to "sacrifice" long-term environmental health for short-term financial gains. These sources of habitat destruction are extremely difficult to control. Most often, tropical countries have approached conservation issues by establishing protected areas; these have been met with a varying degree of success.

Guyana has given protected area status to only a very small percentage of its land. The only National Park (Kaeiteur in Region VIII) is small (ca. 116 km2) and makes up less than one-tenth of one percent of Guyana's area. Other areas in Guyana are presumably open for exploitation, depending on the regulatory agency within Guyana's government that has jurisdiction of the area. The Government of Guyana has been contemplating expanding Kaeiteur National Park, as well as giving some parts of the Kanuku Mountains in the central Rupununi protected area status. In contrast, the protected area systems in Surinam and Venezuela, where most of Guyana's parrot species also occur, are well developed.

Although habitat destruction has greater potential negative effects on populations of most parrot species than harvesting for the wildlife trade, the economic benefits brought by the activities responsible for habitat destruction (see above) and the relative ease with which the wildlife trade may be regulated, has led to the wildlife trade receiving a much greater share of regulatory action. Because a major goal of regulatory agencies and conservation organizations at both national (e.g., the Ministry of Agriculture) and international levels (e.g., CITES) is to maintain healthy wildlife populations, they will seek to regulate possible threats whenever possible; as a result, the wildlife trade has been a much more frequent target than other activities.

Other threats to parrot populations in Guyana are the harvesting of wild birds for the pet markets within Guyana; hunting for food or feather ornaments; and hunting because parrots can be destructive pests in agricultural areas, especially on fruit trees.

There is an urgent need to assess how parrot populations in Guyana are faring in the face of these threats. Foremost is the need to estimate the size of parrot populations, so that any future downward (or upward) trends can be documented. In addition, estimates of population size can give regulators opportunities to determine the levels at which the harvesting of parrots from the wild may be sustainable. Currently, the only data available for population trends are anecdotal recollections from a variety of biologists or naturalists (see species accounts below). There is no information available on population sizes of any parrot species in Guyana.

Although there is a huge market for parrots in the United States, and Guyana formerly exported large numbers of parrots to this country (CITES records), no parrots have been exported from Guyana to the United States since the latter country passed the Wild Bird Conservation Act (WBCA) in 1992. This act requires that countries exporting birds to the United States scientifically show that the harvesting of wild birds is done in a sustainable manner. Therefore, until Guyana shows that their levels of harvesting are sustainable, no parrots may be exported to the United States.

The idea of sustainably harvesting non-timber forest products is at the forefront of many current efforts to conserve tropical ecosystems (e.g., for parrots, see Thomsen and Brautigam 1991, Beissinger and Bucher 1992a, 1992b). The basic premise of sustainable harvesting is that healthy wildlife populations tend to produce more young each generation than is necessary to replenish the population. For populations of stable size, the "excess" individuals produced each breeding season will either emigrate or die from various sources (predation, starvation, etc.). In general, if harvesting levels do not surpass this reproductive "excess," then the populations will remain stable, and the harvesting could be determined to be sustainable. Thus, sustainable harvesting can produce income for those employed in its practice without harming the wildlife populations being harvested (but see criticisms by Ludwig et al. 1993). If some of this income goes directly to those harvesting the product - often people with poor access to other cash economies - it will provide incentive for them not to use the ecosystems sustaining the product for other purposes, such as agriculture for market crops. For products that are exported, such as parrots, the harvested goods increase in value greatly as they are taken from the forest and sold on international markets. Because the product is then bringing foreign capital to the country, and some of that capital is being distributed to the country's poorest residents, the government may act to ensure the continued survival of the products that are sustaining the trade. By "adding value" to functioning ecosystems, sustainable harvesting can be used to promote conservation at every level. As long as harvesting is done at sustainable levels, the export trade of parrots can thus be a major means to promote conservation of a country's ecosystems (Beissinger and Bucher 1992a, 1992b).

Although the ideas of sustainable harvesting are theoretically sound, they often may not work when applied to real situations. One major problem is that short term economic interests (or necessities) may push harvesting to non-sustainable levels without some form of regulation. However, regulating harvesting at sustainable levels has often proven to be difficult. Another major problem is that the product being sustainably harvested may be of marginal economic value (at least in the short term) compared to other more destructive uses of the ecosystems, such as large-scale timber harvesting, large-scale agricultural uses, or extractive mining; these latter activities are usually not sustainable. Tropical countries, strapped for foreign capital, may choose the more destructive activities. However the uses and conservation of forests and other semi-natural landscapes is usually

not determined solely by economic concerns. Because of international and internal concerns, tropical countries are often under pressure to conserve forests and other natural ecosystems. Sustainable uses of these ecosystems are thought to be a way to balance economics and conservation.

CITES AND OTHER LISTINGS OF PARROTS

Although the current status of parrots in Guyana is not adequately known, there are several sources that have assessed the extent to which species are threatened with extinction at a global scale. The foremost international organization concerned with the trade of wildlife is the Convention of International Trade of Endangered Species (CITES), an international body that governs international trade in wildlife species. Countries that have become party to the treaty act in accordance with the rules and regulations promulgated by CITES, which are updated annually. Guyana became party to CITES on 25 August, 1977. CITES only acts on wildlife trade at an international level, so its rulings and listings affect only those species likely to be traded internationally, such as parrots.

CITES places species that are potentially threatened with extinction into one of three appendices (CITES Appendices I, II, or III) that give different levels of protection and regulation. CITES Appendix I species are threatened with extinction and are, or may be, affected by trade. Commercial trade in these species is generally prohibited by the convention, although exemptions are sometimes allowed. Species in CITES Appendix II might become endangered if trade in them is not controlled and monitored in order to avoid utilization incompatible with their survival. International trade in CITES Appendix II species is permitted with proper documentation issued by the government of the exporting country. CITES Appendix III species have been identified by a particular country as being subject to regulation for the purpose of preventing or restricting exploitation.

Of the world's approximately 350 parrot species (Order Psittaciformes: Sibley and Monroe 1990), 44 are listed in either CITES Appendix I; all the others are listed in Appendix II. The only parrot species occurring in Guyana that is listed in Appendix I is the Scarlet Macaw; the other 27 species known from Guyana are included in CITES Appendix II (Table 3). The listing of this species is mainly a result of the precipitous declines of populations in Middle America. Populations in South America, particularly in the Amazon Basin, do not appear to be endangered (Stotz et al. 1997). No parrot species occurring in Guyana is listed in CITES Appendix III.

The Red Data Book for the Americas (Collar et al. 1994), published by BirdLife International (formerly ICBP), also ranks the endangerment of species and gives former and current distribution and status, threats, and needed action for each listed species (Table 3). They also have a multi-tiered system of ranking endangerment. Although 38 species of New World Psittacines were considered threatened in this

volume, none of these occurs in Guyana. The only parrot species in Guyana that fell within their "Near-Threatened" category (Appendix D) is the Blue-cheeked Parrot (*Amazona dufresniana*). The other parrot species found in Guyana were not treated. The inclusion the Blue-cheeked Parrot on this list probably stems from earlier publications (Wege and Collar 1991, Collar and Jupiter 1992) that had given the species a "threatened" status, based on its presumed rarity in the wild and small distribution and not from over-harvesting for the wildlife trade or habitat destruction.

Recently, Stotz et al. (1997) gave each Neotropical Bird species a ranking from one to four depending on assessments of its conservation priority (urgent = 1, high = 2, medium = 3, and low priority = 4). None of the 29 parrot species known from Guyana was assigned an urgent or high conservation priority; only six were assigned a medium priority (Blue-and-Yellow Macaw, Scarlet Macaw, Red-and-Green Macaw, Sun Parakeet, Blue-cheeked Parrot, Festive Parrot); the remaining 23 species were considered of low conservation priority (Table 3).

Table 3. Listings of the status of Guyana's parrot species. The CITES listing is the appendix in which the species appears. The Red Data Book gives the appendix in which the species appears in that publication (Collar et al. 1994). Listings from Stotz et al. (1997) are the conservation priorities (from 1 - 4, 1 = highest priority). Listings are described in greater detail in the text.

Species	CITES	Collar et al. (1994)	Stotz et al.(1997)
Blue-and-Yellow Macaw	2	not listed	3
Scarlet Macaw	1	not listed	3
Red-and-Green Macaw	2	not listed	3
Chestnut-fronted Macaw	2	not listed	4
Red-bellied Macaw	2	not listed	4
Red-shouldered Macaw	2	not listed	4
White-eyed Parakeet	2	not listed	4
Brown-throated Parakeet	2	not listed	4
Sun Parakeet	2	not listed	3
Painted Parakeet	2	not listed	4
Fiery-shouldered Parakeet	2	not listed	4
Green-rumped Parrotlet	2	not listed	4
Dusky-billed Parrotlet	2	not listed	4
Golden-winged Parakeet	2	not listed	4
Tepui Parrotlet	2	not listed	4
Lilac-tailed Parrotlet	2	not listed	4
Sapphire-rumped Parrotlet	2	not listed	4
Scarlet-shouldered Parrotlet	2	not listed	4
Black-headed Parrot	2	not listed	4
Caica Parrot	2	not listed	4
Blue-headed Parrot	2	not listed	4
Dusky Parrot	2	not listed	4
Blue-cheeked Parrot	2	D (near-threatened)	3
Yellow-crowned Parrot	2	not listed	4
Mealy Parrot	2	not listed	4
Orange-winged Parrot	2	not listed	4
Festive Parrot	2	not listed	3
Hawk-headed Parrot	2	not listed	4

METHODOLOGY

Dr. David A. Wiedenfield, who had completed similar projects in Honduras and Nicaragua (Wiedenfield 1993 and 1995, respectively), wrote the proposal for this project (Wiedenfield 1996). In these prior projects, he established a standard methodology for surveying parrots and analyzing the data. The resulting estimates of densities and population sizes were used to recommend export quotas that should be sustainable. I received the contract for this project immediately prior to the time the fieldwork was to commence, so, out of necessity, I have generally followed the design he proposed. His proposal outlined a field season from February to April, designed to correspond with the pre-breeding period for parrots in Guyana (see below for why this important) and with the dry season, which facilitates transportation. I initially visited Guyana from 24 March to 24 May, 1997, when a majority of the censuses were completed. However, during this visit, I became aware that parrots use the coastal plain habitats only in the months (late May to September) following the breeding season. As a majority of the parrots exported from Guyana are harvested from these coastal regions, I felt it was necessary to make a follow-up visit to resurvey parrots in the coastal plain. I made a second visit to Guyana from 2 - 13 September, 1997.

STUDY AREA AND HABITATS

Given its small size, Guyana has a heterogeneous array of natural habitats. The major habitats in coastal regions of the northwest are coastal mangrove forests, seasonally flooded forests, and seasonally flooded savannas and woodlands dominated by various palms. Along the east coast, there are seasonally flooded savannas, riparian forests, and woodlands and forests on white sand. Much of the vegetation in this area has been severely disturbed by human activities. Most of the vast interior is composed of terra firme (= non-flooded) forests and riparian forests. However, montane vegetation (forests, scrublands , and savannas) is found in the tepui area of Regions VII and VIII, and dry interior savannas and tropical deciduous forests dominate the Rupununi area in Region IX.

Because the objectives of the study were to estimate parrot populations for the entire country, an effort was made to visit as much of the country as possible. The country is politically divided into 10 "regions," numbered I - IX (Figure 4). Regions I - V are relatively small in area and border the coast; regions VI - X are much larger and are in the interior. Although all regions were included in the study area and visited during this study, special emphasis was placed on surveying the regions where most of the parrot harvesting takes place. These are the Northwest district (regions I - II), the Georgetown area (regions III - IV and the northern part of Region X), and the Berbice/Corentyne areas (regions V - VI).

The most comprehensive and recent mapping of the vegetation of Guyana is Huber et al. (1995), who delimit 36 vegetation associations. For the purposes of this study, it is most important to recognize habitat types that are being recognized by the parrot populations themselves. Because parrots often make long-distance flights on a daily basis, parrots may not recognize overly fine distinctions in habitats. For these reasons, I needed to combine some of the vegetation associations of Huber et al. (1995) into more general habitats.

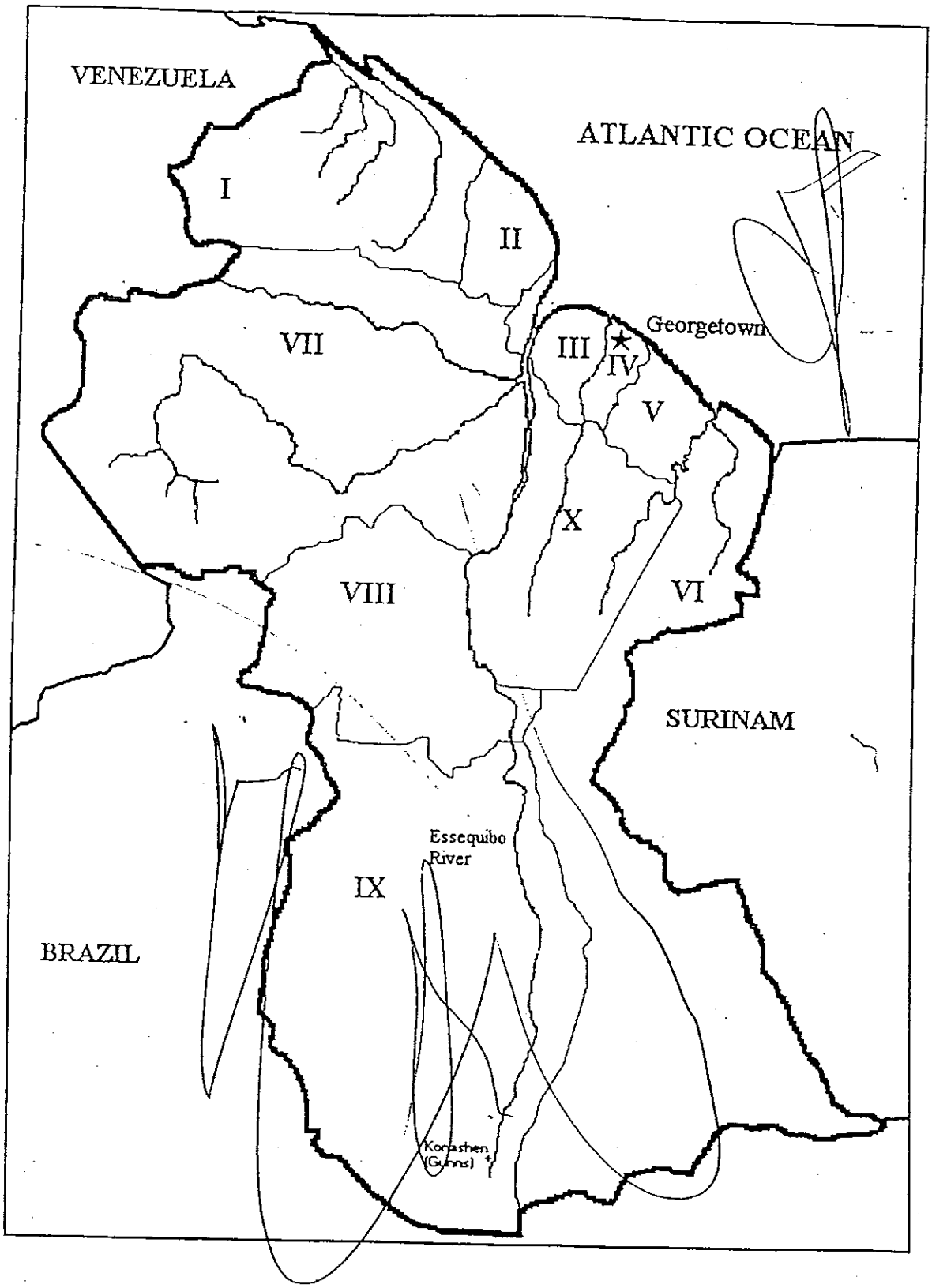


Figure 4. Map of Guyana with political regions (numbered I to X).

Fortunately, Huber et al. (1995) partitioned the 36 associations into five general habitat types: forests (20 vegetation associations), shrublands (seven vegetation associations), savannas and meadows (six vegetation associations), Saxicolous vegetation (one association of small extent, not of further concern here) and anthropogenic vegetation (two associations). They further break down the four general habitat types of concern into more specific categories, which largely form the basis of the strata for which I will analyze the data (see below). Huber et al. (1995) delimit five types of forest (Flooded coastal and lowland forests, Non-flooded lowland forests (often called terra firme forests), Non-flooded lowland forests on white sand, Montane forests, and riparian forests), two types of shrublands (Flooded shrublands on the coastal plain, Non-flooded lowland and Montane shrublands), two types of savanna (Flooded coastal meadows, Non-flooded interior savannas and meadows) and two types of anthropogenic vegetation (Cultivated fields, and Secondary [degraded] vegetation). Nonetheless, a parrot population is still usually not restricted to one of these particular habitats types. For instance a Blue-and-Yellow Macaw population in Region I may use Riparian forests, Flooded lowland forests, and Palm-marsh woodland during the course of a single day.

In this study, I have combined political regions and the general habitat types to yield the strata by which I will analyze the data and estimate parrot densities and populations. These strata and their associated habitats are:

1. East Coast (EC) Stratum. This stratum includes the settled portions of the coast from the Pomeroon River on the border of Regions I and II, east to the border with Surinam (Figure 6). It includes the eastern portion of Region II, most of Regions III (except west of the Essequibo River), IV, and V, and the northern third of Region VI. This stratum is entirely lowland and includes the urban areas of Georgetown, the coastal agricultural areas of the coast, where rice and sugar cane are the major crops, and the various scrub, savanna, and secondary forest habitats on white sand near the coast. Other habitats include various types of Non-flooded lowland forests, Lowland savannas on white sand (in the Timehri area), and Flooded shrublands. Topographically the stratum varies from flat to slightly hilly. Most of the vegetation in this region is heavily disturbed for agriculture or urban areas, although small pockets of secondary forests are interspersed and large stands of mature forests occur on the periphery of the stratum. Many parrots are currently being harvested in this stratum for the export market. I surveyed parrots in this stratum from 28 - 30 March, from 19 - 22 April, and from 4 - 7 September. The total area encompassed by this stratum is 12,780 km^2.

2. Region I (REG 1) Stratum. Region I is also known widely as the Northwest District. This stratum includes much of the coastal plain of Region I (to about 75 km inland) and the western portion of Region II (Figure 7). This area is entirely lowland (< 200 M) and is largely forested. Several different types of Flooded lowland and coastal forests (especially Mangroves and Palm-dominated forests) define the stratum. Riparian forests and Flooded coastal meadows (Palm-marsh woodland and Swamp woodlands), interspersed within the flooded forests, are also important habitats for parrots in this stratum. Topographically, the stratum is mostly flat, although slightly hilly land, with

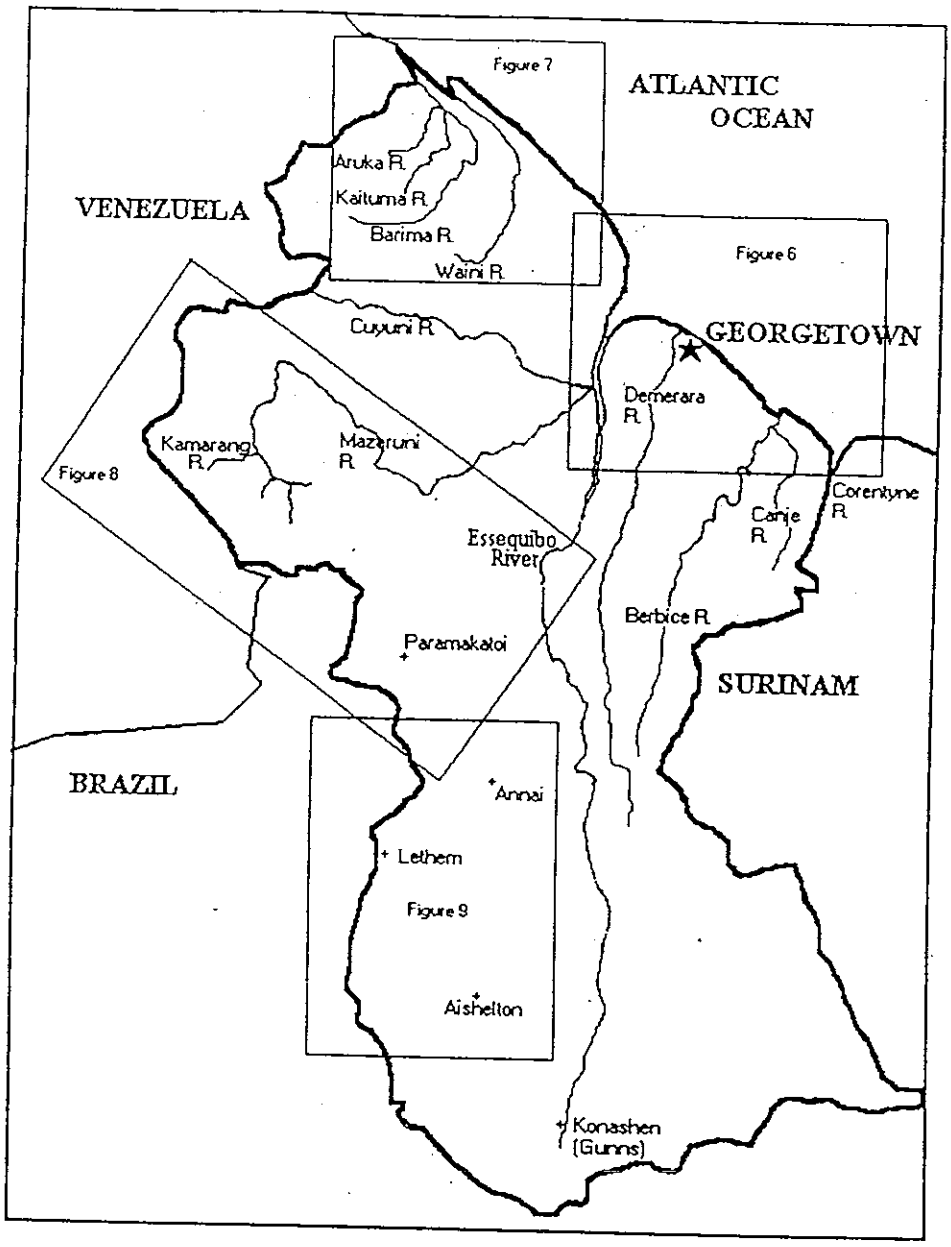


Figure 5. Map of Guyana. Areas within rectangles shown in greater detail in Figures 6-9.

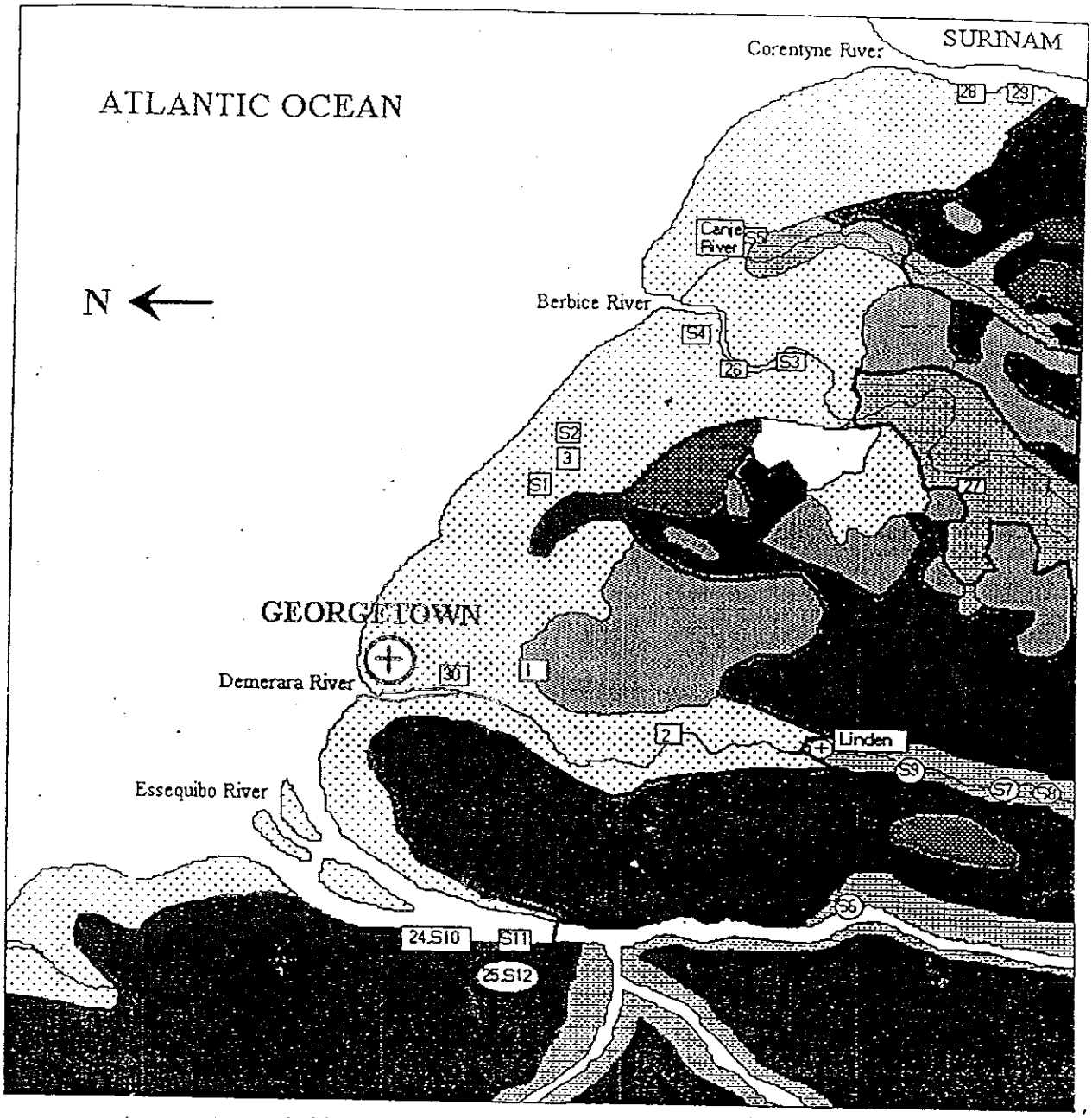
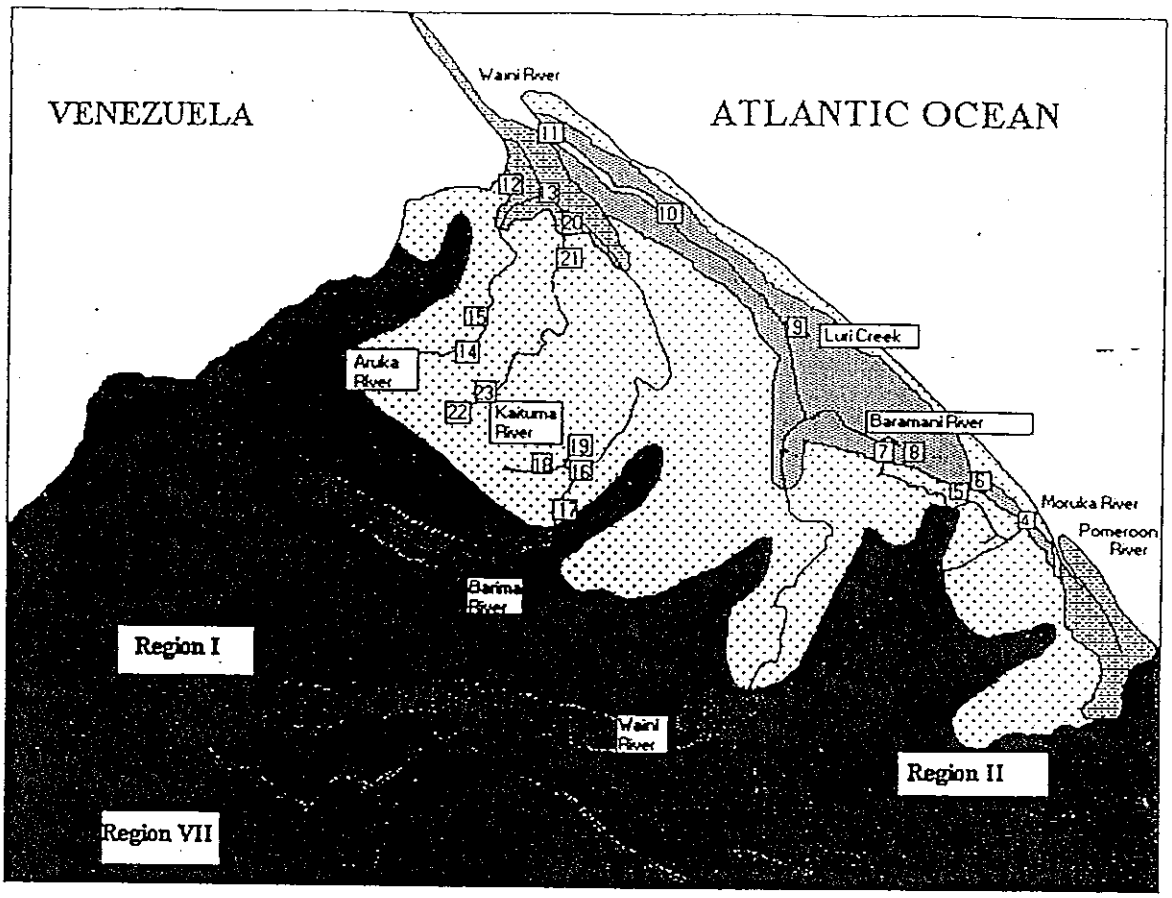


Figure 6. Map of East Coast stratum and northeastern portion of Terra Firme-North stratum, with habitats and survey points.



Region 1 stratum habitats

- Cultivated areas
- Palm swamps, meadows
- Flooded forests, mangrove forests

Terra firme-North stratum habitats (only northwest portion of stratum)

- Riparian forests
- Terra Firme forests, forests on white sand

Figure 7. Map of Region I stratum and northwestern portion of Terra Firme-North stratum, with habitats and survey points.

Nonflooded lowland forests, interdigitates with the flooded forests between the many rivers that course through the region. Disturbances to vegetation in this stratum are centralized near Mabaruma, the regional administrative center, where forests have been cleared for agriculture. In the rest of the stratum disturbances are rather minimal, although Manicol palms are harvested throughout the flooded forests (for heart of palm); the fruits of these palms are a very important fruit for Amazona parrots and macaws. There are currently operating timber operations (e.g., Barama Timber Co. on the Kaituma River) in the hillier forests in the stratum. This area is a major source of parrots for the wildlife export trade in Guyana. I surveyed parrots in this stratum from 3 - 13 April. The total area encompassed by this stratum is 9390 km^2.

3. Kamarang (KAM) Stratum. This stratum (Figure 8) includes the montane areas (> 400 m) of the western two-thirds of Region VII and the northwestern portion of Region VIII. This hilly stratum includes the tepuis, large flat-topped mountains characteristic of northeastern South America. The stratum is dominated by various types of montane forests, although scrublands are scattered at higher elevations, especially in association with limestone outcrops on the tepuis. Although small villages with agricultural plots are scattered throughout the stratum, most areas appear to be little disturbed (pers. obs., during over-flights). Placer mining along the major rivers, especially the Mazaruni, is quite common, although the effects of this activity on parrot populations is probably minimal. Only one exporter currently uses this area to supply parrots for the wildlife trade. I surveyed parrots in this stratum from 24 April to 5 May. Two major areas were visited: Kamarang in Region VII, and Paramakatoi in Region VIII.
The total area encompassed by this stratum is 15,000 km^2.

4. Rupununi Savanna (RUP) Stratum. This stratum is entirely within Region IX, encompassing the western border of the region, which is dominated by Nonflooded savannas . The stratum also includes the Deciduous forest peripheral to the southern parts of the savanna (Figure 9). Although open savannas generally do not provide habitat for parrots, the narrow bands of gallery forests that are found along watercourses within the savanna provide roosting, foraging, and nesting sites for several parrot species. In general, the Rupununi savannas are heavily disturbed by frequent fires (both natural and human-caused) and grazing, although the effects of these disturbances on parrots is difficult to judge. Grazing has decreased substantially in the past decade. I surveyed parrots in this stratum from 6 - 12 May.
The total area encompassed by this stratum is 15,300 km^2.

5. Terra Firme -North (TFN) Stratum. This very large stratum encompasses most of the Non-flooded lowland forests north of 3°40'N. This stratum includes the western portion of Region I, the portion of Region III west of the Essequibo, the lowland (< 400 m) eastern portions of Region VII and VIII, Region IX north of 3°40'N, and all of Region X (Figures 5-9). This stratum is dominated by Non-flooded Lowland Forests, although there are large expanses of Flooded Forest (especially Riparian Forests), and some Non-flooded lowland forests on white sand can also be found in the northeastern corner of the stratum. Most of the area is slightly to very hilly. Disturbance in this region results mainly from timber extraction and large scale open-pit mining. Both activities are widespread in the

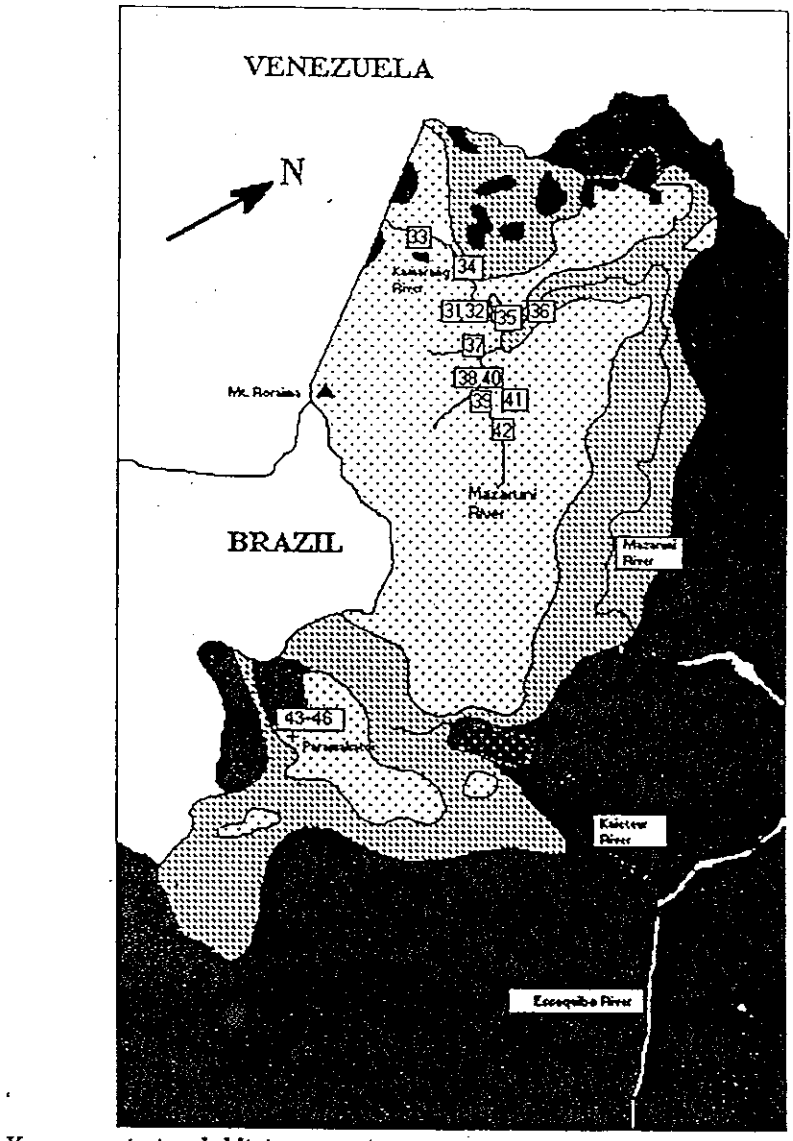
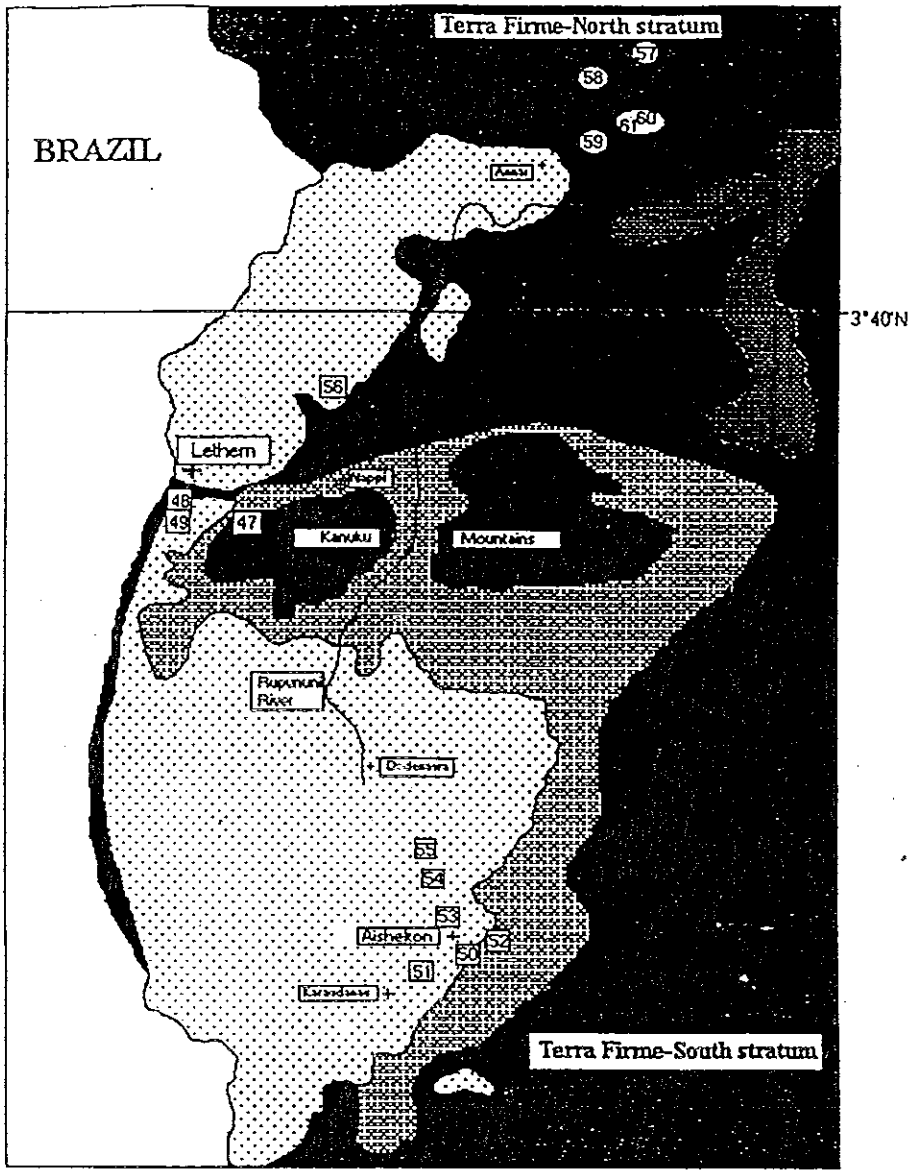


Figure 8. Map of Kamarang stratum and western portion of Terra Firme-North stratum, with habitats and survey points. .



Rupununi savanna stratum habitats (counts in squares)

- Savanna
- Deciduous Forest
- Gallery Forest

Terra Firme-North (north of 3° 40'N) and Terra Firme-South (south of 3° 40' N) strata habitats (does not include Kanuku Mountains) (counts in circles)

- Riparian forests
- Terra Firme / Lower Montane forest

Figure 9. Map of Rupununi Savanna stratum, southwestern portion of Terra Firme-North stratum, and northeastern portion of Terra Firme-South stratum, with habitats and survey points. .

northern portion of the stratum, but forests are still largely intact; disturbances in the southern portion are minimal. Although parrot harvesting occurs near the rivers in Region I, along the lower Essequibo River, and in forests peripheral to the Rupununi savannas (near Annai), most of the parrot populations are untouched in this stratum . I surveyed parrots in this stratum on 17 April, from 18-20 May, and from 9-12 September. The total area encompassed by this stratum is 85,070 km^2.

6. Terra Firme-South (TFS) Stratum. This large stratum encompasses most of the southern third of the country. This stratum includes the all of Region IX south of 3°40', except the Rupununi savannas and the deciduous forests surrounding these savannas, and the southern two-thirds of Region VI (Figures 5 and 9). Montane forests in the Acari and Kanuku Mountains are not included. This stratum is dominated by Non-flooded lowland forests, although there are large expanses of Flooded forest (especially Riparian forests). Most of the area is flat to slightly hilly. Disturbance s in the stratum are minimal. Parrot trapping currently occurs only in the Rupununi savannas and peripheral areas, although some harvesting occurred in the Gunn's Strip area, near the village of Konashen, in the early 1990s (K. Herzog, pers. comm.). I surveyed parrots in this stratum from 18-20 May. The total area in this stratum is 46,590 km^2.

General habitat types were also assessed during the travels to survey points during this study. These travels included low over-flights in fixed-wing aircraft and travel by truck or car overland; the approximate routes are shown in Figure 10.

COLLECTING DATA

There are several different techniques for collecting data that can be used to estimate densities and population sizes of bird populations (Bibby et al. 1992). However, the options available for collecting this data were constrained by the need for estimating absolute densities, as well as by the social behavior of parrots and their propensity to make long foraging flights on a daily basis (Wiedenfield 1993, 1995, Casagrande and Beissinger 1997). The short duration of this study, the necessity to cover as much of the country as possible, the need to estimate densities for several species simultaneously, and the difficulties in transportation within Guyana further constrained the options available.

In both Honduras and Nicaragua, Wiedenfield (1993,1995, respectively) surveyed parrots using a variable circle point count methodology. In this technique, all parrots or groups of parrots that can be seen from a single point are recorded over a proscribed duration. For every observation of parrots, the species, the group size if more than one bird occurs together, and the closest approach of the individual or group to the survey point are recorded. A similar methodology was used in both Nicaragua and Honduras, although the time spent at each point differed between the two projects. In Honduras, Wiedenfield spent the entire count period at one site during either the morning or afternoon. He then analyzed each 15 minute period as an independent sample from that point. In Nicaragua, Wiedenfield spent only 15 minutes at each survey point; after completing a point, he would then move to another point.

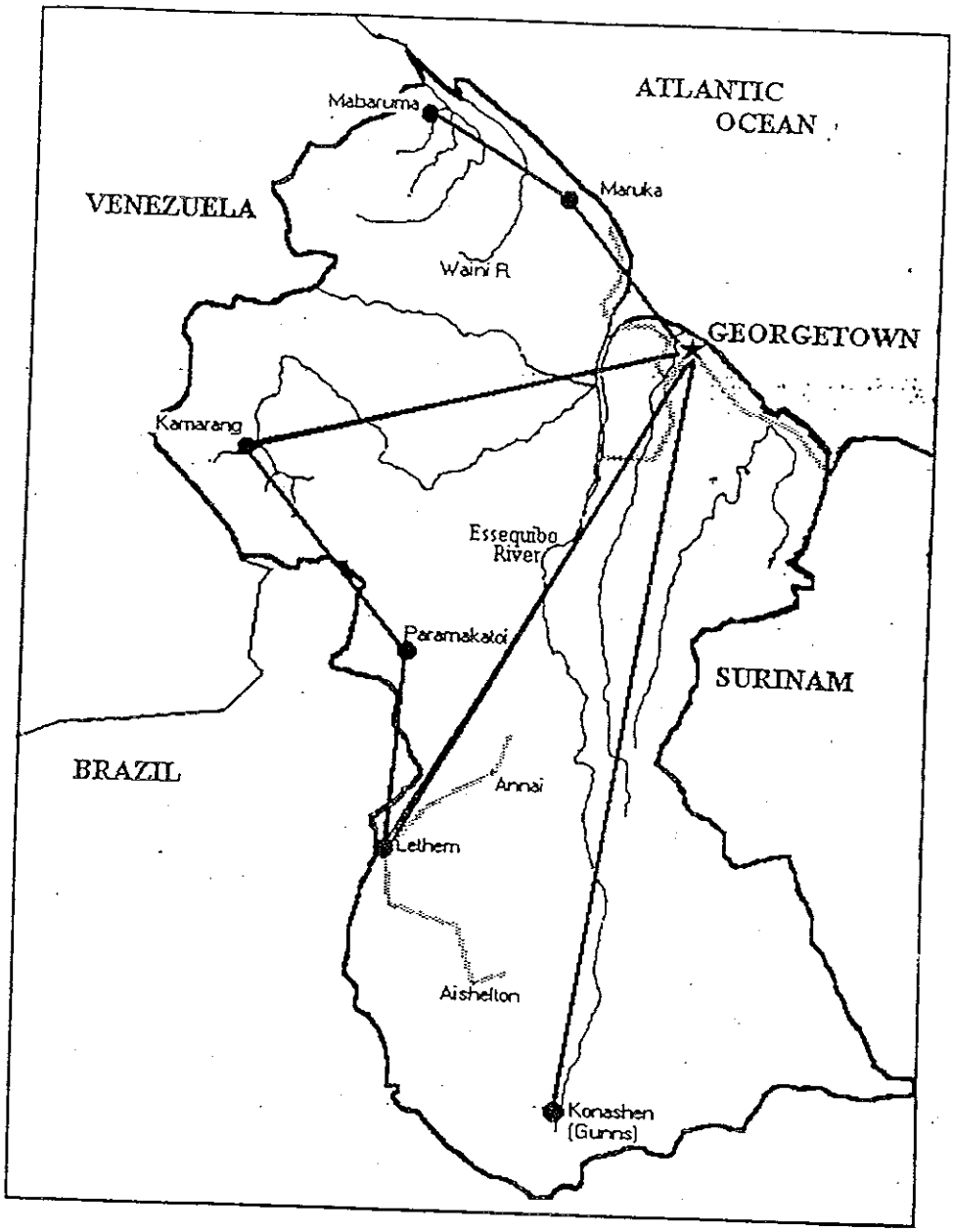


Figure 10. Map of Guyana showing over flights and major roads traveled during study.

Although Wiedenfield proposed to follow the Nicaragua design in Guyana (15 minutes per point), I opted to follow the Honduras methodology. In general, I spent an entire morning or afternoon at one point, although where transportation permitted, I may have moved once during a morning or afternoon. Although there are some problems associated with analyzing data collected in this manner (see below), time and transportation limitations constrained the feasibility of using the 15 minutes/point methodology. In most areas of Guyana, transportation between survey points was by small boats with outboard motors. Often conditions permitted the use of only small motors (25 Hp or less), so a move to another point, which had to be at least 5 km (straight line) away (see below), usually took between 30 and 45 minutes. Even in the Rupununi savannas, where transportation was by 4-wheel drive vehicle, road conditions allowed only very slow driving and a move between points often took at least 30 minutes. If the 15 minutes/point method was employed, then most of the productive periods when parrots were flying (i.e., 0600-0800h; see below) would have been spent moving between points and not surveying. If more field days were available, then the 15 minutes/point methodology would have been more feasible and preferred.

In the field the start time was noted, and at 15-minute intervals, a new period would begin. For the analyses, the day was broken into 15 -minute blocks starting at 0530 for morning counts and 1530h for afternoon counts. Each 15-min. count period was then assigned to one of the blocks, depending on which period the majority of the 15 minutes was spent (e.g., if a count began at 0555h, the first period was assigned to the 0600-0615h block because 10 minutes were spent in this block and only 5 in the 0545-0600h; the ensuing two periods were then assigned to the 0615-0630h and 0630-0645h blocks, respectively). This method eased data-taking in the field because a time for each observation need not be noted.

For each observation of parrots, the species, the number of individuals, and the distance from the observer to the closest approach by the parrots was recorded. On almost all counts, the count team consisted of at least myself (Kratter) and Rhonda Urlin from the Guyana Ministry of Agriculture. Generally, Kratter would observe, identify, and estimate distance, and Urlin would record the data on prepared field sheets. On two counts, Urlin was not present and a different person was used to record data. Urlin and other assistants with us (drivers, boatmen, guides, etc.) would often initially spot the birds. Urlin would occasionally measure distances. At each count an optical rangefinder was used to estimate distances to landmarks around the count point. These landmarks would then be used to help estimate distances to the birds. At each point, Urlin gave the point a name and number, and recorded the following: 1) date: 2) start time and end time; 3) latitude and longitude to the nearest 100th of a minute using a Global Position Satellite (GPS) receiver; 4) elevation; 5) habitat type; 6) types and degree of disturbances; 7) canopy cover within 100 m of the point; and four weather variables (percent cloud cover, number minutes rain, intensity of rainfall, and wind).

To compute population densities and population sizes (see below), it is assumed that the parrots observed at different points are different individuals. Because many parrot species may fly long distances between their roosting and foraging areas, the survey points have to be quite far apart to ensure that parrots seen at different points represent different individuals. In this study each point was at least 5 km (in a straight line) from other points. To ensure that points were 5 km apart, we used the GPS receiver to calculate distances to nearby points.

In each region, guides were used to help find survey points and help with logistics of transportation. In each region, efforts were made to sample the different habitats present. However, the mode of transportation often limited our ability to visit all habitats. In four of the six strata(all but East Coast and Rupununi Savannas) we were limited to near-river habitats because our only means of transportation was boats. Conversations with local trappers often were used to determine areas where parrots had been seen recently. Because most parrots are seen in flight, survey points were chosen that had good visibility of the sky, for example along rivers, at the edges of farm clearings, or along road cuts.

Optimally, a number of points would be placed randomly within each region and stratified by the different habitats present. Unfortunately, difficulties in transportation would severely limit the ability to reach randomly selected points, and the need to have points placed within some sort of clearing (see above) often limited selection of habitat types. Therefore, in this study the points were not randomly selected. In the areas where trappers were used for transportation and in helping to select survey locales (mainly Region I, the Berbice and Essequibo Rivers, and in the Rupununi Savannas), the density estimates of parrots may be inflated because the points may have been selected where parrots had been seen recently (see above). However, the same transportation limitations faced by us are also in effect for the trappers. As we were often using trappers for transportation, our survey points often coincided with areas of intensive trapping. Areas with trapping most likely have lower densities than areas without trapping. Although it is difficult to assess the degree of each of these countering effects, it is assumed that these factors balanced in this study.

The timing of the surveys is important in the computation of harvest quotas, because harvest quotas should be set using only the number of adult birds capable of breeding. The number of breeding adults in the populations is at the greatest proportion immediately prior to the breeding season. If a January to May breeding season is assumed (see below), then the surveys would be optimally conducted from October to December. Unfortunately, the breeding season was inadequately known when the proposal was written (Wiedenfield 1996a), and this investigator was constrained to follow the proposal (see above).

ESTIMATING DENSITIES

Estimates of population densities and sizes were computed using the software program DISTANCE (version 2.2), which has been widely used to calculate densities when wildlife populations are censused using point or line transects (Buckland et al. 1993; for parrots see Lambert 1993, Wiedenfield 1993, 1995). This program starts by comparing several different models that plot the detection probability of the subjects at various distances from the point or line transect survey for each stratum. The model that best fits the input data is chosen for the analyses. The survey data can be divided into strata that may represent different habitats or regions. If the study species occurs in clusters of individuals (like parrots), the program will compute an average group size. The program then uses the detection probability model to estimate the density of individuals (or clusters), and then, using areas of the strata, estimates the population sizes. Areas of the strata defined above were calculated using a dial planimeter

on the map by Huber et al. (1995). The template DISTANCE program for this study is given in Appendix I.

In this study, the survey data was broken into 30-minute blocks; each block was then used as a repeated sample from the same point. Although the data was collected in 15-minute blocks, I used a longer duration sample during the density analyses because most the parrots passing a survey point during one morning or afternoon count are probably different individuals.

The detection probability models computed by DISTANCE are generally reliable only if there are 10 or more observations (J. Laake, pers. comm.). An option in the program is whether the detection probability models are chosen for each stratum ("Detection by stratum" option) or chosen using the data cross all strata ("Detection all" option). In this study, if I wanted to obtain density estimates for any strata that had fewer than 10 observations for a species, I used the "detection all" option. If all strata had more than 10 observations, I used the "detection by stratum" option.

Moving subjects tend to create problems in estimating densities. Although spacing the count points 5 km apart has most likely alleviated the problem of double-counting individuals (see above), the long, twice-daily movements of many parrot species increases the likelihood that parrots will be encountered at any one survey point. If parrots move greater than the detection diameter of one survey point in a morning or afternoon (generally about 1.5 km), then these parrots are passing through more than one potential survey point. The analysis program, however, assumes that the parrots are occurring at only one point. If parrots are making very long flights, such as 30 km each way, which is not unfeasible, then the parrots are passing through 15 possible points. The DISTANCE software will then tend to overestimate density proportionally to the number of potential survey areas that the parrots are passing through (J. Laake, pers. comm.). Unfortunately, without knowledge of the commute lengths of these parrots, it is impossible to correct for this bias. In addition, this positive bias increases with survey time spent at each point.

INTERVIEWS

In each area visited, efforts were made to interview people connected in any way with the wildlife trade. The purpose of these interviews was to determine the scale of the trade in each region, and to assess the impacts of the wildlife export trade on the local or national economies. These informants were also asked to assess the degree of internal trade in parrots (within Guyana), the existence of any illegal trade in parrots, and the degree of mortality of parrots in captivity.

RESULTS

SOCIAL FACTORS

Interviews. Almost all of the informants could be classified into one of five groups: 1) trappers, those who actually capture the birds; 2) middlemen, those who buy from trappers and then sell to exporters; 3) exporters, those licensed to export wildlife; 4), regulatory personnel, those in employ of the Ministry of Agriculture who in some way regulate the trade; and 5) those only marginally or not at all connected with the trade.

I interviewed nine people who classified themselves as trappers, eight middlemen, seven exporters, and two regulatory personnel. Several middlemen and exporters were formerly involved in the wildlife trade as either trappers or middlemen. The amount and quality of information varied greatly among and within the different groups. It was often difficult to assess the accuracy of the data given by the informants. It should be kept in mind when reading this report that much of the social data was collected from a very limited sample with a high degree of error. This is especially true for prices and numbers of parrots caught.

The basic structure of the wildlife trade in Guyana is simple, although there are a number of variations. Usually, parrots pass through a three-tiered sequence as they pass from wild flying individuals until they are exported from Guyana. Parrots are initially trapped by local trappers, who use a variety of methods (see below). The parrots are then sold to middlemen that visit the trappers. Middlemen usually buy from a number of trappers in a particular area. The middlemen then either bring the parrots to Georgetown or other major transportation center (Lethem, Charity, Parika, etc.), where they are sold to the exporters. In Region I, where the trade is more extensive then elsewhere, a second level of middlemen may be used; these are usually Amerindians that buy parrots from trappers and sell them to middlemen in places like Moruka village. The exporters have a quarantine station (most in Timehri or Georgetown) where the parrots are kept until they are exported through Chedi Jagan International Airport in Timehri. Most international aspects of the wildlife trade are complex and beyond the scope of this report.

Regulatory Aspects. The regulatory agency in charge of the wildlife trade is the Ministry of Agriculture. Within the Ministry, the Wildlife Services Division in particular regulates the wildlife trade. Currently, Wildlife Services is composed of two officers, and a three person secretarial staff. A five-person Wildlife Advisory Committee, composed of regulatory personnel and others involved in the trade, including one member from the exporter community, advises the Ministry on issues of the trade (see below).

The Ministry has maintained an annual closed season from 1 January - 30 April, when parrots are not allowed to be trapped or exported. This period corresponds with the presumed breeding seasons of most parrot species. As a result, parrots that are incubating or feeding young are protected.

Almost all other regulatory action occurs at the exporter level. All exporters must be licensed by the Ministry of Agriculture. The export licenses allow the export of several species of parrots, several toucans, various snakes, lizards, and frogs, some monkey species, and a few other mammals. There are currently 22 exporters, although the Ministry was set to issue more licenses during my visit in 1997. The Ministry of Agriculture has begun an attempt to license middlemen and trappers, but most of the informants at these levels that were interviewed during this project stated that they were not licensed, and several did not know of any requirement to be licensed. Wildlife caught in the Rupununi and shipped overland to Georgetown is supposed to be checked by an officer of the Ministry of Agriculture in Lethem.

When parrots are received by the exporters, they must undergo a quarantine period in an approved quarantine station before they can be exported. There are a number of regulations involving the construction of quarantine stations; these regulations are enforced to minimize disease transmission and to provide safe and comfortable housing for the wildlife. The quarantine and inspection are to ensure that birds are healthy before being exported. Quarantine stations are regularly inspected by an officer of Wildlife Services.

After quarantine, the parrots must also undergo an inspection by a Wildlife Services officer before they can be exported. Prior to inspection, the exporter must apply for a permit to export; it is at this stage that quotas are enforced and taxes are levied. Each parrot species has a declared export value, which I presume is the average price of the species when individuals are sold from the exporter to the importer. For each individual parrot exported, Wildlife Services assesses a levy that is 20% of the import value. Individual quotas for the exporters are set simply by dividing the national quota by the number of export licenses (currently 22).

In matters concerning the wildlife trade, the Ministry of Agriculture consults with the Wildlife Advisory Committee. This five-member committee is composed of representatives from the wildlife trade (one exporter), the chief of the Wildlife Service Division, an appointee of the Minister of Agriculture, a representative from the Bureau of Amerindian Affairs, and an unaffiliated member. The committee has no declared power to create regulations, but is intended to help the Ministry of Agriculture make decisions involving the trade. Most exporters feel that the committee lacks sufficient political power to help their causes, and that the committee reverts to easily to Ministry of Agriculture's opinions on important decisions.

Trappers. The dominant method of catching parrots is by having a trapper hide himself high in a tree, and then, after attracting a parrot to the tree, the trapper snares the bird using a lasso on a long pole. This method is also used in the Delta Amacuro region of Venezuela Desenne and Strahl 1991). Palms are the dominant trees used by the trappers, in particular the Manicol or cabbage palm, the fruits of which are a favorite for foraging amazons and large macaws. The dense central portion where the palm fronds emerge provides an easily constructed hide or blind where the trapper can hide. In palms, the trapper usually sets out a perch for parrots to land. The lack of major lateral branches in palms increases the possibility that the sought-after parrot will land on the perch set by the trapper.

The dominant means of attracting parrots is using a "calling bird." The calling bird, an already captive parrot of the species being sought, is sent up to the blind (by rope) and

induced to call. The calling bird thus attracts wild flying individuals to the tree, and, there being few perches in a palm, the wild-flying individual will often land on the perch set out by the trapper. The trapper then can use the pole with noose to lasso the birds. The trapped birds are then sent down to a person on the ground. Sometimes nooses are set beforehand on the perch, or a sticky resin may be used on the perch. Occasionally nets are used to capture birds. A trapping team usually consists of two people, one to hide in the tree and catch the birds, and the other to send the calling birds up and to handle the caught birds after they are sent down by the trapper.

Alternate methods were used only in a few areas. In Kamarang, an area where few parrots are harvested, locals sometimes climb nest trees to remove nestlings. Only once did I hear of trappers felling nest tress to get young. This method, used in certain parts of South America (Beissinger and Bucher 1991, pers. obs.) is very destructive. Not only does the felled tree go to waste and the nest is lost, but many parrot populations are thought to be limited by number of nest sites, so decreases in nest sites by felling nest trees will lead to decreases in populations.

Trappers usually trap close to the areas in which they live. In many areas the trappers are Amerindians, especially in Region I and the Rupununi. They are often near-subsistence farmers without access to other cash markets, and trapping wildlife often is the major means of providing cash for their households. The trapping season is usually from late May through December, although most birds seem to be caught from June to August. This period is usually during a slack time in agricultural activities for farmers, at least in Region I (L. Patoir, pers. comm.), and thus present farmers with an opportunity to raise additional cash without interfering with their agricultural activities. Trappers bring their caught parrots to their villages or to nearby market villages, where they are sold to middlemen, and, on occasion, exporters. They rarely, if ever, go to Georgetown.

The materials required for trapping (calling birds, cages, resin, twine, transportation to trapping areas) often are given to them by the middlemen or, more rarely, by exporters. Middlemen or exporters often will tell trappers what parrots are needed for the market. But in many cases, I found that trappers will catch any birds that they think is marketable; several trappers did not know that certain species (e.g., Hawk-headed Parrot or Scarlet Macaw) had zero quotas and did not have legal markets.

I interviewed nine trappers. All interviewed trappers were well experienced in the wildlife trade; they average experience was 12.7 years. I asked each informant the average number of parrot sold every year (for each species), and the price given to the trapper. The numbers sold seemed especially variable, and I think that some informants did not completely understand the question. One informant's numbers were not believable (i.e., the sum of parrots trapped per season was many 1000s, including hundreds of large macaws) and were not used further in this analysis.

The trappers I spoke with sold their parrots to recognized middlemen or exporters (this is not surprising because meetings with most trappers were set up by the middlemen and exporters).

None of the trappers stated that they sold birds for internal markets or to buyers from Surinam (see below).

Middlemen. There is a great deal of variance in how middlemen - which can be either men or women - are used in the wildlife trade. Some exporters (at least two) do not use middlemen at all and have their own network of trappers. Both of these exporters trained the trappers and gave the requisite materials for trapping (cages, calling birds, etc.) to the trappers. One of these exporters regularly brings trappers into the field with him to catch birds. Several other exporters deal both with middlemen and with trappers directly.

Usually, however, middlemen serve to bring birds from the trappers to the exporters. I interviewed seven different people who identified themselves as middlemen. Most of the middlemen I interviewed began in the wildlife trade as trappers, and then established themselves as middlemen. Several of the middlemen had applied for but not yet received an export license. The middlemen usually work in a particular region, where a number of trappers are used. A trapper may work with more than one middleman, but just as often it seems that a trapper will sell to only one middleman. The middlemen generally sold to a number of exporters.

Exporters. As described above, the exporters must place bought birds in quarantine stations that must meet a number of standards maintained by the Ministry of Agriculture. The exporters usually have a small staff (three to five employees), who help maintain the stations. Parrots are kept an indeterminate amount of time in the stations, depending on when the birds become available and when the market is opened by the Ministry of Agriculture. The market has been opened later than usual the last few years, so many birds have had to stay for several months in the quarantine stations. For the species that have a steady demand (large macaws and Amazona parrots), most exporters seem to try to buy as many birds as their quota permits when the season opens and they find buyers for the birds. If market values fall or buyers cannot be found, then the birds may be kept until the following year.

After reaching the export destination, parrots usually pass through a number of hands before they are sold at resale value to the public. Prices increase substantially at each transaction. Resale values of parrots in the United States (J. Sailer, pres. comm.) were, on average, 11.6 times the export value from Guyana (Table 4a). However, because the United States has largely stopped the import of parrots from Neotropical countries, these values from the United States are for captive-bred parrots, which often have higher resale values than parrots harvested from the wild (J. Sailer, pers. comm.). In addition, since passage of the Wild Bird Conservation Act (p. 131) the retail values of several parrots that were formerly imported in large numbers (e.g., Orange-winged Parrot, Red-bellied Macaw) have skyrocketed because of diminished supply (J. Sailer, pers. comm.). Presumably, if wild birds were once again imported, these values would substantially decrease.

Table 4a. Prices and values of parrots at the exporter level and the retail values in the United States, including ratios of exporter to middlemen and to trapper values Ratio = after tax value/middleman or trapper values (from Table 4b). *middlemen and trapper prices unavailable, so values calculated by using overall ratios and declared values. Retail values from J. Sailer (pers. comm.).

Species	total Guyana quota	EXPORTERS								RETAIL U.S.	
		declared value/bird	price/bird-after tax	total value	price/bird bought	value bought	net value	exporter/middlemen value	exporter/trapper value	price/bird	retail US/export value
Blue-and Yellow Macaw	720	252	210	151200	33.04	23786	127414	6.36	12.05	850	3.37
Scarlet Macaw	0										
Red-and Green Macaw	900	288	240	216000	40.71	36643	179357	5.89	12.22	1200	4.17
Red-shouldered Macaw	1000	50	42	41667	8.93	8929	32738	4.67	6.31	600	12.00
Red-bellied Macaw	1500	65	54	81250	17.26	25886	55364	3.14	15.17	1500	23.08
White-eyed Parakeet*	300	72	60	18000	10.24	3073	14927	*	*	150	2.08
Brown-throated Parakeet*	500	14	12	5833	2.56	1280	4553	*	*	150	10.71
Fiery-shouldered Parakeet*	120	36	30	3600	5.12	615	2985	*	*	350	9.72
Painted Parakeet*	300	101	84	25250	14.37	4310	20940	*	*	150	1.49
Golden-winged Parakeet*	180	22	18	3300	3.13	563	2737	*	*	275	12.50
Green-rumped Parrotlet*	600	22	18	11000	3.13	1878	9122	*	*	100	4.55
Black-headed Parrot	600	50	42	25000	6.16	3696	21304	6.76	12.96	750	15.00
Blue-headed Parrot	36	36	30	1080	2.32	84	996	12.92	7.00	625	17.36
Dusky Parrot	0										
Blue-cheeked Parrot	0										
Festive Parrot	0										
Yellow-crowned Parrot	1000	86	72	71667	16.61	16607	55060	4.32	13.53	850	9.88
Orange-winged Parrot	9000	32	27	240000	2.01	18080	221920	13.27	9.53	700	21.88
Mealy Parrot	1000	72	60	60000	10.09	10089	49911	5.95	11.45	600	8.33
Hawk-headed Parrot	0										
total	17756			954847			799329				
							average	7.03	11.14		10.41

Table 4b. Average prices and values of parrots given by trappers and middlemen during interviews for parrot species in Guyana. *middlemen and trapper prices unavailable, so values calculating by using overall ratios and declared values from Table 4a

species	TRAPPERS			MIDDLEMEN					
	total quota	price/bird	total value	price/bird	total value	price/bird	value bought	net value	middleman /trapper value
Blue-and Yellow Macaw	720	17.43	12549	33.04	23786	17	12549	11237	1.90
Scarlet Macaw	0	9.64				10			
Red-and Green Macaw	900	19.64	17679	40.71	36643	20	17679	18964	2.07
Red-shouldered Macaw	1000	6.61	6607	8.93	8929	7	6607	2321	1.35
Red-bellied Macaw	1500	3.57	5357	17.26	25886	4	5357	20529	4.83
White-eyed Parakeet*	300	6.46	1939	10.24	3073	6	1939	1134	*
Brown-throated Parakeet*	500	1.62	808	2.56	1280	2	808	472	*
Fiery-shouldered Parakeet*	120	3.23	388	5.12	615	3	388	227	*
Painted Parakeet*	300	9.07	2720	14.37	4310	9	2720	1590	*
Golden-winged Parakeet*	180	1.97	355	3.13	563	2	355	208	*
Green-rumped Parrotlet*	600	1.97	1185	3.13	1878	2	1185	693	*
Black-headed Parrot	600	3.21	1929	6.16	3696	3	1929	1768	1.92
Blue-headed Parrot	36	4.29	154	2.32	84	4	154	-71	0.54
Dusky Parrot	0	2.14				2			
Blue-cheeked Parrot	0	7.14				7			
Festive Parrot	0	7.14				7			
Yellow-crowned Parrot	1000	5.30	5298	16.61	16607	5	5298	11310	3.13
Orange-winged Parrot	9000	2.80	25179	2.01	18080	3	25179	-7098	0.72
Mealy Parrot	1000	5.24	5238	10.09	10089	5	5238	4851	1.93
Hawk-headed Parrot	0	23.81							
total			87384		155518			68134	
								average	2.04

OTHER FACTORS IN WILDLIFE TRADE

Aside from trapping for the export market, parrots that are trapped in Guyana may be il smuggled from the country, may die or become too defective to be sold before being exported, or may be sold for the internal markets of Guyana. In addition, trapping has differential effects on parrot populations depending on what age classes are being harvested. Each of these topics will be treated separately below.

Ages of harvested parrots. The harvesting of parrots from wild populations does the least damage to the population when juvenile age classes are harvested. Juvenile age classes suffer the greatest mortality in natural populations, and harvesting birds in these age classes will affect the reproductive potential of the population much less than if breeding age classes are harvested. For these reasons, it is often recommended that nestling parrots be harvested (e.g., Beissinger and Bucher 1992a). In general, the methods used to trap parrots in Guyana (see p. 35), however, do not differentiate among age classes.

Nevertheless, the trapping methods use in Guyana probably capture mostly juvenile parrots. This method of trapping will have varying effects on parrot populations depending on what time of the year the parrots are trapped. The trapping of most species occurs immediately following the breeding season. At this season, juvenile birds are at the highest proportion in the populations, so more juvenile birds are likely being harvested than if harvesting occurred at other times of the year. In addition, juvenile birds are relatively naive as compared to mature birds, and probably are more effectively lured to traps by calling birds. Most trappers interviewed stated that they capture far more young birds than adult birds.

Illegal trade. Because smuggling (known as back-tracking in Guyana) is illegal, anybody directly involved with this activity almost surely would not report it to me during interviews. Nonetheless, almost every informant stated that they knew that some smuggling was occurring, and most stated that smuggling was a very significant problem.

The major smuggling activity appears to be birds and other wildlife trapped in Guyana are being smuggled across the border to Surinam, where the birds are then legally exported through Surinam's legal wildlife trade. One exporter mentioned that some parrots were further smuggled through Surinam into French Guiana. The amount of this illegal cross-border traffic in parrots is potentially immense. At least two exporters stated that they felt at least as many birds were being smuggled to Surinam as were being legally exported from Guyana. The exporter community expressed deep concern to me about this problem, not only because it diminished stock of Guyana's wild parrots, but also because the Surinamese are then competing with Guyanese exporters on the world market. Apparently several exporters have gone to the Ministry of Agriculture, the customs agency, and the national police to stop this activity, but each agency has stated that either the problem is another agency's concern or that their agency does not have the human resources to tackle the problem.

Smuggling from Guyana to Surinam appears to occur primarily in the major settled areas of the coast. Several informants told me of what is probably the major means by which wildlife

is smuggled from Guyana to Surinam. The large ferries that sail regularly from Region I to Georgetown or Parika arrive with lots of parrots during the trapping season. These parrots are presumably transported by middlemen from Region I and are then sold to whomever gives the best price among the buyers that meet the ferry on arrival in Georgetown. Often several Surinamese buyers are among the buyers present. In addition, some Guyanese buy birds and then smuggle these themselves to Surinam (various informants, pers. comm.). From Georgetown the birds are transported overland on roads to the Corentyne River, where they can be smuggled across to Surinam on short boat rides, This border crossing apparently has very little policing. The waters of the river are within Surinam, so Guyanese police or customs officers have no jurisdiction once the boats are on the water. Therefore, the only time that smugglers may be apprehended is as they are leaving the Guyanese shore with birds.

One exporter stated that several years ago most of the parrots that were trapped in the Corentyne River region, where a number of trappers work, were being smuggled to Surinam. However, since the exporter has established his operation in the area, the smuggling activity has decreased because a Guyanese buyer is now present in the area (A. Singh, pers. comm.). Even if the smuggling of birds caught in the Corentyne area has decreased, the problem of birds caught in Region I and transported in the method described above still is present.

There are several reasons why Guyanese middlemen may sell to Surinamese buyers. First, Surinam currently exports several species (especially Scarlet Macaw, Hawk-headed Parrot, Blue-cheeked Parrot, and Dusky Parrot) that have high demand overseas but currently have zero quotas in Guyana (Table 5). Several trappers informed me that they still trap these species in Guyana. However, because these parrots cannot be legally exported from Guyana, they must be smuggled. Second, Surinamese buyers may out compete Guyanese buyers by buying at higher prices. I was told that Surinam's levy is currently lower than Guyana's, but I was unable to confirm this. In addition, Surinam's market opens earlier than Guyana's (especially in the last few years when Guyana's market opened late), and the Surinamese can bring birds to the overseas market earlier in the season when buyers are more apt to buy at higher prices.

The growing trend in the level of parrots being exported from Surinam, along with the decline of parrots being exported from Guyana (Figure 11), results in a surfeit of parrots being trapped in Guyana and a steady demand in Surinam. Informants indicated that Surinam has yet to build the trapping and middleman infrastructure necessary to satisfy their growing demand, and has instead depended on birds smuggled from Guyana. This supply and demand situation became acute when Guyana ceased exporting parrots during the 1993-95 moratorium (see p. 11), so during those years the only available market for Guyana's trapped parrots was in Surinam.

A business person in Mabaruma (Region I) not affiliated with the wildlife trade indicated that some smugglers brought birds caught in Venezuela's Delta Amacuro region (immediately northwest of the border with Guyana) into Guyana where they are sold. This smuggling route may have been used intensely during the 1980's, and Venezuelan birds may have made up a majority of the birds legally exported during this period from Guyana (Desenne and Strahl 1991). However, illegal trade along this route now appears to be much lower. K. Pilgrim,

Table 5. Reported exports and current quotas of Psittacines from Surinam, 1983-1996.

species	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1986-96 average	current quotas
Blue-and-Yellow Macaw	8	9	17	85	181	215	361	307	403	196	609	619	387	442	346	650
Scarlet Macaw	0	9	10	56	4	2	1	1	0	5	0	150	10	48	25	100
Red-and-Green Macaw	0	12	4	28	7	50	45	53	95	49	144	204	117	189	89	250
Chestnut-fronted Macaw	1	1	12	31	33	51	83	101	99	40	144	185	58	154	89	250
Red-bellied Macaw	0	0	0	0	60	151	301	233	272	102	302	211	109	243	180	470
Red-shouldered Macaw	2	30	0	13	7	28	42	64	14	42	64	185	53	111	57	150
White-eyed Parakeet	0	20	67	18	291	468	236	432	192	124	228	345	170	193	245	792
Brown-throated Parakeet	551	41	269	844	1269	1500	1028	1287	662	236	536	896	298	393	814	2710
Sun Parakeet	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
Painted Parakeet	0	40	47	236	560	348	248	270	337	229	342	380	241	167	305	854
Green-rumped Parrotlet	234	39	396	2852	2321	2738	1872	783	370	177	345	0	302	3	1069	4632
Golden-winged Parakeet	34	84	124	330	686	622	443	585	264	110	119	490	424	294	397	1194
Black-headed Parrot	202	212	386	820	452	629	467	555	314	173	405	984	513	771	553	1378
Dusky Parrot	200	0	62	84	20	219	143	344	327	162	122	243	133	110	173	800
Blue-headed Parrot	411	29	321	472	515	509	517	772	400	332	69	658	451	442	467	1500
Blue-cheeked Parrot	0	0	0	0	8	10	7	44	15	2	12	21	29	66	19	70
Yellow-crowned Parrot	3	1	4	3	56	31	53	45	46	54	105	199	366	444	127	580
Orange-winged Parrot	304	378	769	985	1477	1627	2112	1886	1792	881	3454	3639	3105	2583	2140	4800
Mealy Parrot	10	2	0	26	34	76	84	63	44	24	143	177	152	233	96	450
Hawk-headed Parrot	0	21	4	67	111	100	104	113	98	82	74	155	146	309	124	300
total	314	401	773	1078	1622	1803	2300	2062	1934	987	3671	3971	3403	3125	2360	

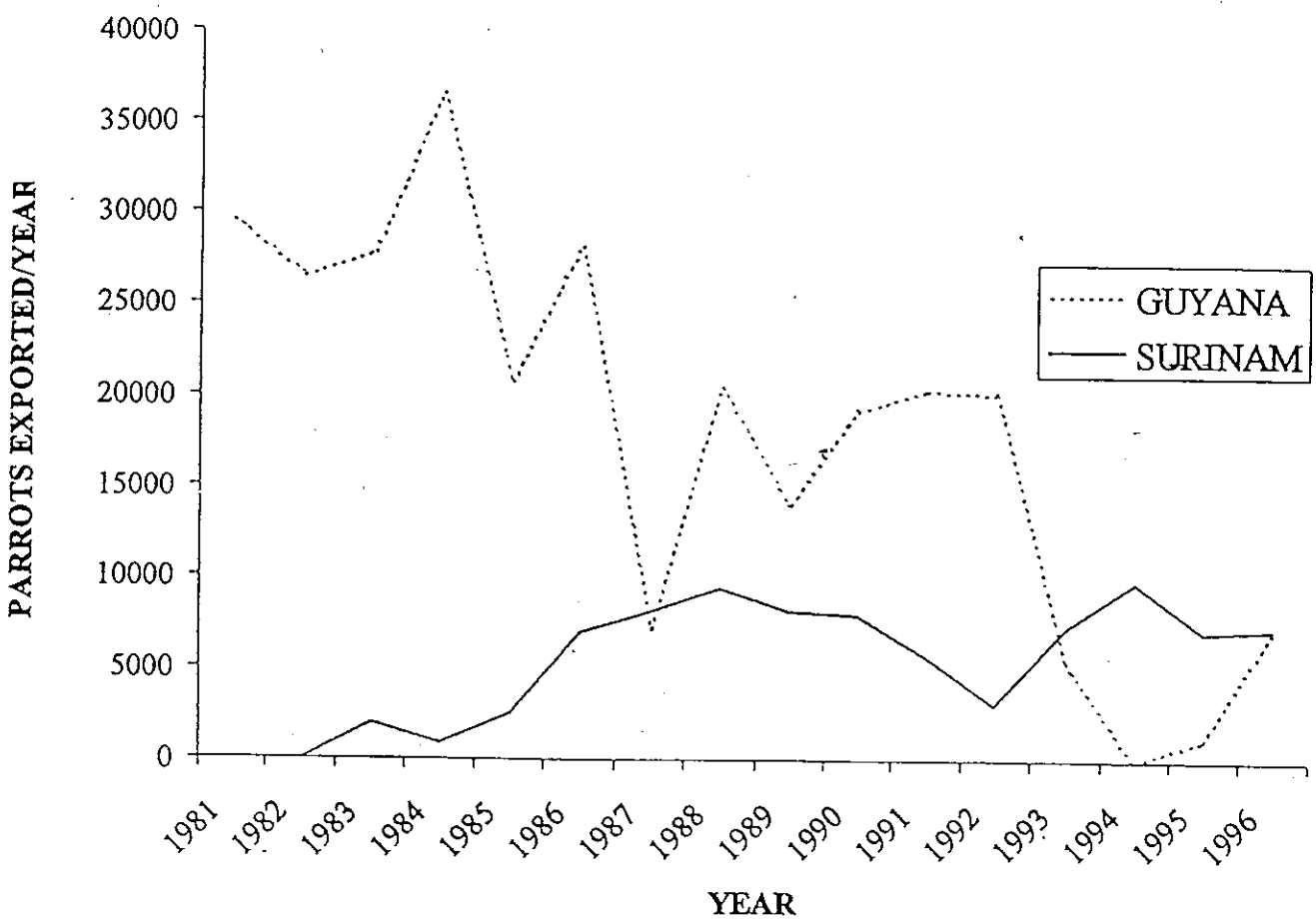


Figure 11. Number of parrots reported as exported from Guyana and Surinam from 1981 - 1997. Numbers are from CITES records

head of Guyana's Wildlife Service Division in Guyana, stated that there have been no recent reports of this illegal trade. The drops in Guyana's quotas and export levels in recent years (Figure 11) have significantly reduced the demand for trapped parrots, and Guyana appears already to trap more parrots than allowed by the export quotas. Therefore, competition among trappers should drive down prices for Guyanese parrots; parrots caught in Venezuela should not be as competitive because of transport costs. Since 1981 Venezuela has had a very small wildlife export trade in parrots (CITES records).

The smuggling of Sun Parakeets to Brazil may have been a problem in the past in the Rupununi area of Region IX (see species account for Sun Parakeet). This species is now so rare in Guyana that smuggling is no longer probable or possible. Although informants in the Rupununi area stated that they knew of the smuggling problems on the coast (to Surinam) they did not think that any smuggling was occurring in the Rupununi district.

Mortality of captive populations. The levels of mortality in captive parrots in Guyana are difficult to assess. Nearly every informant involved with the trade stated that mortality was a negligible problem, although informants would be unlikely to provide information that indicated they handled birds poorly. Additionally, parrots that are defective in some way are not bought by middlemen or exporters (most informants at that level; pers. comm.); these defective birds are treated as an additional source of mortality. It should be remembered that it is economically advantageous for all buyers and sellers involved to keep their birds in good health and to reduce mortality. Economic advantages are greatest if the parrots are kept for a minimum amount of time.

Mortality is likely greatest in the initial weeks following capture. In addition to possible injuries or death at the time of trapping, newly captured birds are highly stressed because of the new surroundings and new diet, and their probable perceived threat of predators (people). Unfortunately, in these crucial first few weeks, trappers often do not have ready access to good cages, food, and veterinarian care that would ease stress on the birds. In contrast, the exporters tend to be well educated in care of their birds, and mortality is probably much lower. Several (most?) exporters have staff veterinarians to maintain the health of their captive wildlife. Many middlemen and exporters stated that they train their trappers on how to handle birds and they provide trappers with materials (e.g., cages). The Wildlife Services Division of the Ministry of Agriculture has regulations for and periodic inspection of the exporter's quarantine stations to reduce mortality and stress to the parrots. The enforcement of regulations concerning care of captive wildlife before they reach exporters does not currently exist.

Most informants stated that mortality was from 1- 10 percent. In addition, middlemen and exporters stated that they reject from 1-10% of the birds they are offered to buy. Assuming that seven percent of parrots die or become too defective to sell while with the trapper, five percent die or become defective while with the middlemen, and three percent die or become defective while with the exporter, about 15 percent of the initial number of parrots trapped will not be exported because of mortality. This figure is the same as that used by Schouten (1995) in his study of Surinam parrot trade.

Internal markets and hunting. In comparison to the export market, the internal market for parrots in Guyana appears to be small. Almost every informant, at every level (i.e., trappers, middlemen, exporters), stated that demand for the internal market was ten percent or less of the demand for the export market. K. Pilgrim (pers. comm.), head of the Wildlife Services Division of the Ministry of Agriculture, stated that a "vague approximation" would be about 1000 birds /year go to the internal market. Although one informant (G. Watkins, a long-time employee for a conservation project; pers. comm.) stated that nearly every house in interior villages had some parrot as a pet, I did not see this in my travels. At most, interior villages had a few to several pet parrots, but most houses did not have one. Most of those kept were Amazona parrots (Blue-cheeked in Kamarang, Yellow-crowned, Mealy, and Orange-winged elsewhere), but I also saw Painted Parakeets and Golden-winged Parakeets. I never saw a pet macaw in interior villages.. In areas where parrots are not trapped for the export trade, pets are usually taken as nestlings from nest trees. One informant mentioned that nest trees may be cut down to get at the nestlings, a very destructive means of acquiring parrots (see trappers

section above). In areas where parrots were trapped, local villagers often kept parrots for using as calling birds. Some birds may have been kept that were they were not able to sell (see mortality section below).

Apparently, parrots and macaws are fairly commonly kept as pets in Georgetown and along the settled areas of the coast. They are regularly sold in markets, especially near the piers at Starbroek market. Because my visits did not coincide with trapping seasons, the only parrots I saw at markets were Green-rumped Parrotlets.

In interior regions, I asked informants (including many that are not connected with the wildlife trade) whether parrots or macaws were ever hunted for food; this is a common practice in many parts of Amazonia (pers. obs.). Subsistence hunting may have dramatic effects on the population densities of parrots; for instance Thiollay (1989) found that Red-and-Green Macaw densities were much lower on plots where indigenous people hunted. In Guyana this appears to be a minimal problem; one informant each in Paramakatoi and Kamarang stated that some local people hunted parrots and macaws for food. The Paramakatoi informant also stated that parrots and macaws were more often shot when they raided agricultural crops (for review of parrots as agricultural pests, see Bucher 1992). This same information was given to me by the chief of the Ministry of Agriculture's Hinterland Program Division (J. Woolford, pers. comm.), who regularly travels to and communicates with farmers in these areas. Because no trapping of parrots for the wildlife trade occurs in these areas, the parrots do not have any monetary worth for the local people, aside from meals or as a destructive pest, so shooting them is not without foundation.

Summary. A summary of the effects of smuggling, mortality, and internal markets is shown in Figure 12. From the above results, it is assumed that approximately 50 percent of the parrots that are trapped are smuggled out of Guyana, 15 percent die or become too defective to be exported (mostly before sale to exporters or smuggling to Surinam), and 10 percent go to internal markets. Thus, for every 1000 trapped in Guyana, only 375 are exported (Figure 12), or 2.6 parrots are trapped for every bird exported.

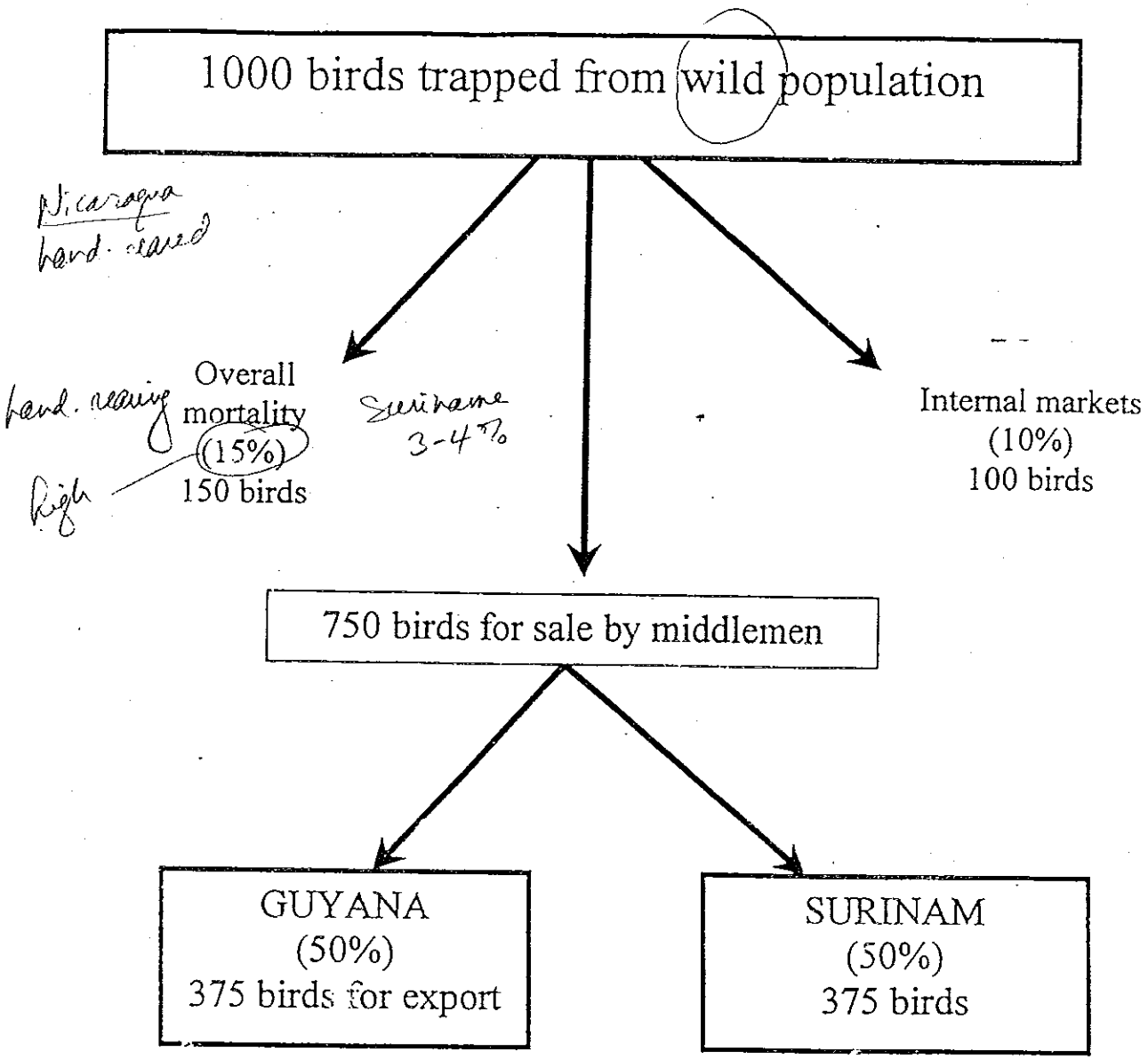


Figure 12. The flow of birds of a hypothetical sample of 1000 parrots trapped in Guyana. Percentages and numbers probably vary with different species, different locales, and the individual trappers or middlemen. See text for computation of percentages.

ECONOMICS

Using country wide quotas and the declared export value per bird established by the Ministry of Agriculture, the total potential export value of parrots in Guyana is US$ 1,147,976 annually (Table 4a, Figure 13). This value does not include income from birds smuggled to Surinam or internal markets, which bring money to trappers and middlemen. The potential annual taxation that goes to the Wildlife Fund is US$ 190,969.

At the exporter level in Guyana (minus the 20% levy), the gross market value of parrots is US$ 954,847.00; subtracting the price at which the parrots were bought (from the middlemen or trappers, Table 4a), a country-wide net value of $799,329 is reached. Using individual quotas (approximately 1/22 of the national quotas), the potential gross annual income from parrots is US$ 43,957 per exporter, and the potential net income is $36,902 per exporter. However, these figures are only if the entire quota is sold for each parrot species; exporters never sell their full quota for every species. In addition, the overhead costs of the exporters cuts significantly into these net values. The quarantine stations probably create the largest amount of overhead (rent or mortgage, materials, staff). If parrots are kept at the stations for significant periods, costs increase (from food for the parrots, mortality, etc.) and incomes decrease. It is noteworthy also that parrots are not the only wildlife sold by the exporters. Almost all exporters also sell other wildlife species that are legal to export (see above), although parrots make up a majority of the income.

Using the middlemen's figures for the price per parrot and number of parrots sold, I calculated the annual income generated by parrots for middlemen. The gross average income earned for middlemen was US$ 22,841 for the seven middlemen used in the analysis. The average net value (after subtracting the price at which the parrots were bought, see below) was US$ 9941.00; their incomes ranged from $370.00 to $27,600. It seems likely that some positive bias is present in the data or analyses and that the average income is far smaller.
Using country wide quotas and the prices per bird given by the middlemen, the gross market value of parrots at the middleman level in Guyana is US$ 155,500 (Table 4b). This figure is probably quite a bit larger because internal and smuggling markets bring additional money to middlemen (see above); in addition, mortality after the parrots are sold to exporters is not included. With these factors and mortality included, 2.6 birds are harvested for every parrot exported (Figure 13). Fewer parrots actually reach the middlemen because of mortality before the birds are bought. Assuming that 1.75 birds are sold by the middlemen for every bird exported results in a gross income of US$ 272,125. Subtracting the price at which the parrots were bought from the trappers (Table 4b), a country-wide net value of US$ 75,511 is reached at the middleman level in Guyana. In addition to the buying costs, middlemen have a number of overhead costs that are not included, such as transportation costs and costs of materials given to the trappers (see above). In any case, the US$ 75,511 could support only 8 middlemen in all of Guyana if the estimated average income for middleman (calculated above) is used. It seems more likely that some positive bias is present in the data or analyses, and that the average income is far smaller. If it is assumed that US$ 1000 would represent a significant increase to a Guyanese middleman's annual income, then the gross income could be distributed to 76 middlemen. It is noteworthy also that parrots are not the only wildlife

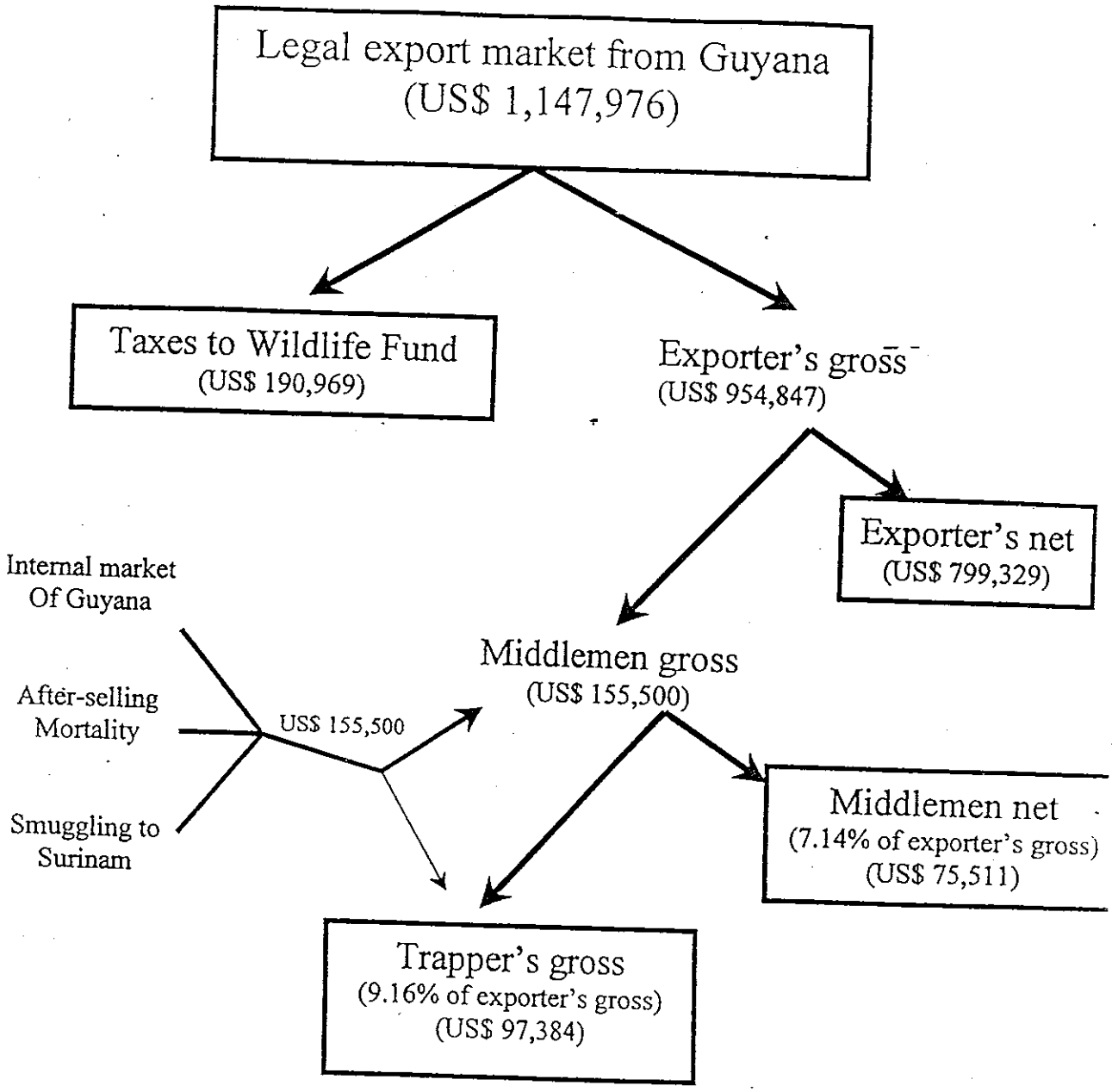


Figure 13. Flow of income to people involved in the parrot trade in Guyana. Gross and net dollar values and percentages do not include income from internal markets, after-selling mortality (mortality that occurs after birds are sold to the next higher level), and smuggling.

sold by the middlemen. In addition, the trappers may sell any wildlife legal to export (see above), although parrots make up a majority of the income.

Using the trapper's figures for the price per parrot and number of parrots sold, I calculated the annual income generated by trapping parrots. The average income earned was US$ 2476 for the eight trappers used in the analysis; their incomes ranged from $368 to $5376. It seems more likely that some positive bias is present in the data or analyses and that the average income among all trappers is far smaller.

If the country-wide quotas and the prices per bird given by the trappers are used, the gross market value of parrots at the trappers level is US$ 87,384. As with the middlemen (see above), birds may be sold for internal markets or to buyers that smuggle birds to Surinam. Birds may also die after they are sold by the trappers. With all of these factors included, 2.6 birds are harvested for every parrot exported (Figure 12). Fewer birds than this are sold by trappers because most mortality occurs prior to the birds being sold by the trappers (see above); therefore I will assume that 2.25 birds are sold by trappers for every bird exported. The resulting market value at the trapper level is US$ 196,614. Using this larger value and the estimated annual income per trapper, the gross income would be distributed over only 79 trappers. However, if it is assumed that US$ 500 would represent a significant increase to a Guyanese trapper's annual income, then the gross income could be distributed to 393 trappers. It is noteworthy also that parrots are not the only wildlife sold by the trappers. In addition, the trappers may sell any wildlife legal to export (see above), although parrots make up a majority (67%, Figure 2) of the income.

On average, the exporters sell their parrots for 703% higher than the price at which they are bought from the middlemen, and 1114% higher than the price sold by trappers (Table 4a). On average, the middlemen sell their parrots for 204% higher than the price at which they are bought from the trappers (Table 4a). Of the total after-tax values of the legal parrot trade in Guyana, 83.7 percent goes to exporters, 7.14 percent goes to middlemen, and 9.16 percent goes to trappers (Figure 13).

The total number of Guyanese that economically benefit from the export trade of parrots is difficult to determine because of the complex network of buying and selling (see above). Using the potential economic figures and employment levels computed above (which assume that the entire quotas are sold), approximately 584 people in Guyana would receive significant income form the parrot trade every year (Table 6). Many other people would also benefit through the selling of materials (food, cages, etc.) and transportation (flights, gas, motors, vehicles, boats, etc.). Using these figures (Table 6), each exporter supports three middlemen and eighteen trappers.

Table 6. Number of Guyanese potentially employed by the trade in parrots.

level	number employed
trappers (at US$ 500.00 per year/trapper)	393
middlemen (at US$ 1000.00 per year/trapper)	76
licensed exporters	22
staff at quarantine stations (4 per station)	88
regulatory personnel	5
total	584

SURVEYS

Overall summary. A total of 79 surveys were conducted at 75 different points; 67 surveys were conducted during the March-May period (at 65 points) and 12 were conducted in September (at 12 points, two points were repeated from the March-May period). Appendix II gives details (exact location, date, time, habitats, etc.) of each survey point; Figures 5 - 9 show the survey point locations. A total of 10,484 parrots was counted, representing 22 species. The overall rate of parrots recorded per ~~unit~~ time, using the 15-minute count periods (516 total), was 20.32 birds/count period or about 81 birds per hour (Table 7).

The rate and number of parrots recorded varied greatly among counts. Four counts recorded more than 500 individuals; the two highest, 741 on count S12 and 633 on count 30 (both in the East Coast Stratum) were dominated by Orange-winged Parrots. The third highest count (612 parrots on count 51 in the Rupununi Savanna stratum) was dominated by Red-bellied Macaws, and the fourth highest (524 on count 59 in the Terra Firme-North stratum) had a variety of species. The highest rate of parrot observations, 150 birds/count period on count 5 (Region I stratum), consisted mainly of Red-bellied Macaws. Twelve counts recorded more than 50 parrots/count period; these were equally distributed among strata (Figure 14). The lowest number and rate of parrots (both zero) was recorded on count 47 in the Rupununi savanna. Three other counts (count 7 in Region I, count 55 in the Rupununi savannas, and count 60 in Terra Firme-North recorded less than 10 parrots. Twenty-one counts recorded fewer than 5 parrots/count period (Figure 14). The Kamarang stratum, and too a lesser extent the East Coast April stratum, had the most counts with relatively low rates of parrot observation, while the East Coast September stratum had the most counts with a relatively high rate of observation (Figure 14). However, the strata did not vary significantly in the average number of parrots recorded per count period (Table 7), indicating that the abundance of parrots is similar across all the strata.

Table 7. Survey results for sum of all parrot species. Count periods are 15 minutes. S=September count (all others March-May); *count not used in estimates for density (rain, etc.); **count at repeated point.

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ count period
EAST COAST APRIL				
1	AM	12	144	12.00
2	AM	12	381	31.75
3	AM	12	243	20.25
30	AM	10	633	63.30
24	AM	10	65	6.50
26	AM	8	71	8.88
27	AM	6	74	12.33
28	AM	2	23	11.50
29	AM	3	38	12.67
total		75	1672	22.29
REGION 1				
4	PM	1	31	31.00
5	AM	3	450	150.00
6	AM	5	236	47.20
7	AM	3	7	2.33
8	AM	6	228	38.00
9	PM	1	8	8.00
10	AM	3	88	29.33
11	AM	7	351	50.14
12	PM	5	125	25.00
13	AM	4	151	37.75
14	PM	6	45	7.50
15	AM	6	36	6.00
16	AM	5	48	9.60
17	AM	4	38	9.50
18	PM	7	20	2.86
19	AM	9	88	9.78
20	AM	3	97	32.33
21	AM	5	142	28.40
22	PM	8	41	5.13
23	AM	9	59	6.56
total		100	2289	22.89
KAMARANG				
31	PM	5	10	2.00
32	AM	11	154	14.00
33	AM	10	59	5.90
34	AM	9	30	3.33
35	PM	6	26	4.33
36	AM	10	170	17.00
37	PM	6	296	49.33
38	AM	10	93	9.30
39	PM	6	69	11.50
40	AM	8	42	5.25
*41	PM	5	10	2.00
42	AM	6	12	2.00
44	AM	13	66	5.08
45	AM	10	172	17.20
46	AM	11	98	8.91
total		126	1307	10.37

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ Count period
EAST COAST SEPT.				
S1	PM	4	151	37.75
S2	AM	6	110	18.33
S3	PM	4	216	54.00
S4	AM	8	79	9.88
S5	AM	6	136	22.67
S10	AM	8	175	21.88
S11	PM	6	741	123.50
total		42	1608	38.29
RUPUNUNI SAV.				
47	PM	4	0	0.00
48	AM	7	10	1.43
49	AM	3	37	12.33
50	AM	6	249	41.50
51	PM	6	612	102.00
52	AM	9	112	12.44
53	PM	6	151	25.17
54	AM	3	177	59.00
55	AM	2	4	2.00
56	AM	4	25	6.25
total		50	1377	27.54
TERRA FIRME-N				
57	AM	10	49	4.90
58	PM	8	161	20.13
59	AM	10	524	52.40
*60	PM	2	6	3.00
61	PM	4	97	24.25
S6	AM	8	92	11.50
S7	AM	4	13	3.25
S8	AM	4	20	5.00
S9	PM	6	58	9.67
S12	AM	8	71	8.88
*25	PM	11	61	5.55
total		75	1152	15.36
TERRA FIRME-S				
62	AM	7	42	6.00
62	AM	9	167	18.56
63	AM	10	239	23.90
64	PM	5	225	45.00
64	AM	5	300	60.00
65	PM	4	101	25.25
total		40	1074	26.85
overall total***	apr	508	10479	20.63

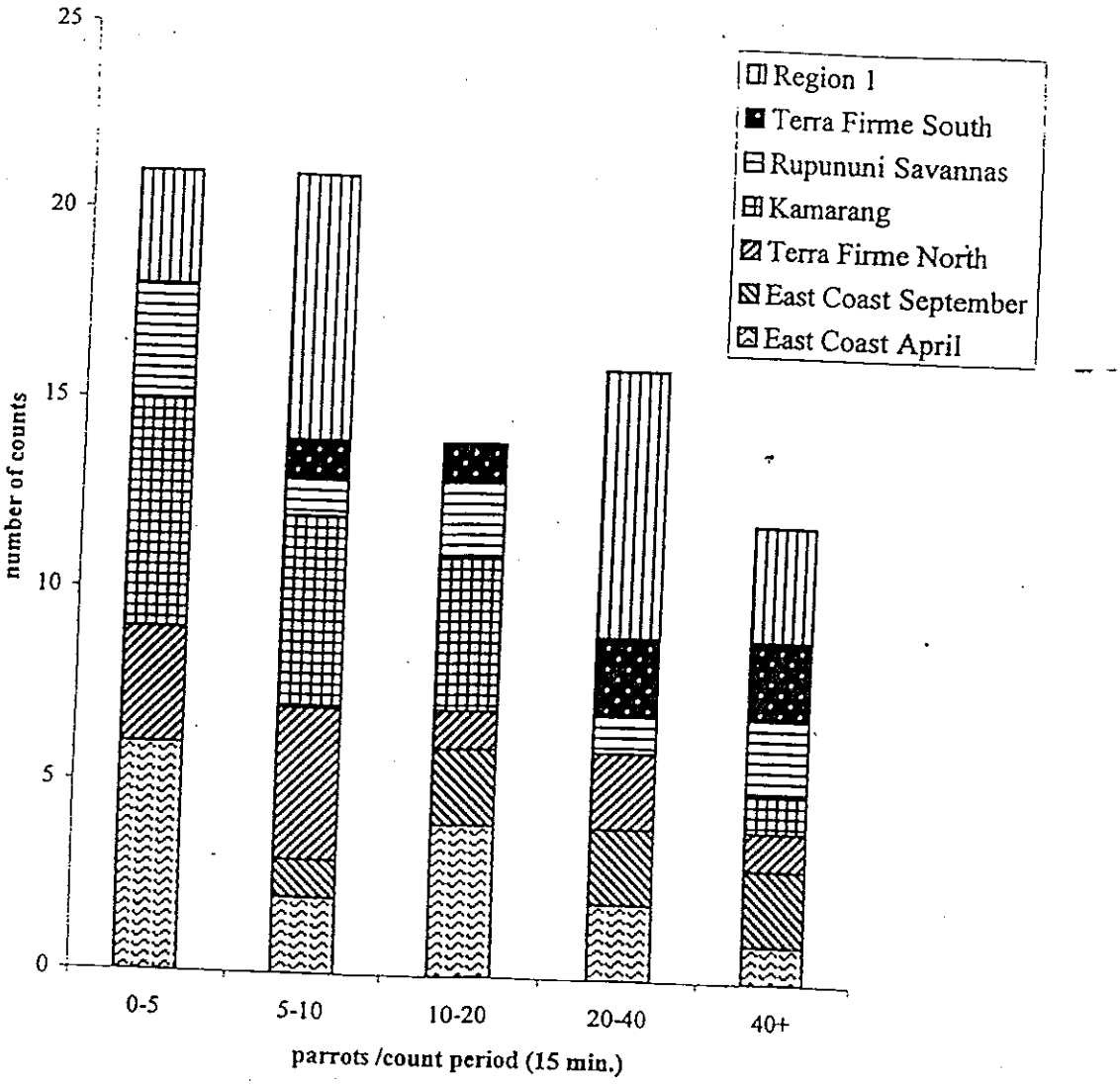


Figure 14. Rate of parrot observations by stratum.

There was some trend toward seasonal differences in the number of parrots recorded per period. In the only contrast available between the March-May and September periods, the East Coast stratum had a much greater rate of parrot observations in September (35.4/count period) than in March-April (19.8 birds/count period) (Table 8); however, this contrast was not significant ($t=1.46$; $p=0.168$). In this stratum, large differences in rate of observations between March-April and September were especially notable for Blue-and-Yellow Macaw, Brown-throated Parakeet, Blue-headed Parrot, and Orange-winged Parrot (all recorded at greater rates in September). Only two species (Red-bellied Macaw, Red-shouldered Macaw) showed a much greater rate of observation in April in this stratum (Table 8).

Most informants reported that most parrot species breed at the beginning of the year (January -May), and, during this period, they are scarce and difficult to encounter. In the coastal strata (East Coast and Region I) the informants reported that parrots increased greatly in abundance

Table 8. Comparison of survey results in March-April and September for counts (A) and species (B) in the East Coast stratum.

A.

count number	birds/count period	
	MARCH - APRIL	SEPTEMBER
1	12.00	
2	31.75	
3	18.92	
24/S10	7.22	35.00
26	8.88	
27	12.33	
28	11.50	
29	12.00	
30	63.30	
S1		30.20
S2		18.33
S3		43.20
S4		8.78
S5		19.43
S11		92.63
average±SD	19.76 ± 17.89	35.37±27.74

B.

	birds/count period	
	MARCH - APRIL	SEPTEMBER
Blue-and-yellow Macaw	0.26	2.31
Red-and-Green Macaw	0.00	0.20
Red-bellied Macaw	9.12	2.24
Red-shouldered Macaw	2.47	0.80
Brown-throated Parakeet	0.59	3.67
Green-rumped Parrotlet	0.00	0.31
Golden-winged Parakeet	0.45	0.00
Caica Parrot	0.05	0.00
Blue-headed Parrot	0.05	4.33
Dusky Parrot	0.01	0.07
Blue-cheeked Parrot	0.00	0.00
Yellow-crowned Parrot	0.36	0.24
Mealy Parrot	0.03	0.00
Orange-winged Parrot	8.45	21.20
Amazona sp.	0.53	0.36
total	22.35	35.73

during the May-June rains, and that the abundances remained high until October or November. The scant data on the breeding seasons of parrots (mainly from Surinam; see individual species accounts below) shows that the majority of breeding records are during this period, but there were scattered records throughout the year for many species. It is also possible that food resources are determining the seasonal use of the coastal plain by parrots. The flooded forests that dominate coastal plain are low in tree diversity, and, presumably, the fruiting season of one or two important trees, such as the Manicol Palm, may determine when parrots use these habitats. In contrast, Terra Firme forests are renowned for extremely high tree diversity, which would most likely lead to a less seasonal availability of fruit.

Overall, there were 54 surveys conducted in the morning and 24 conducted in the afternoon. Although there were slightly more parrots recorded per count period during the afternoon counts (26.0/count period) than in the morning (20.8/count period), the difference was not significant ($t=0.787$; $p=0.434$). The average number of parrots recorded per count period in morning surveys peaked just after daybreak at about 6:00 AM and then declined to about 18 birds/period and kept steady at that rate until 8:15 AM (Figure 15). In afternoon surveys, the average number of parrots recorded per count period increased sharply after 4:15 PM and peaked at 5:15 PM, but declined sharply towards dusk (Figure 15).

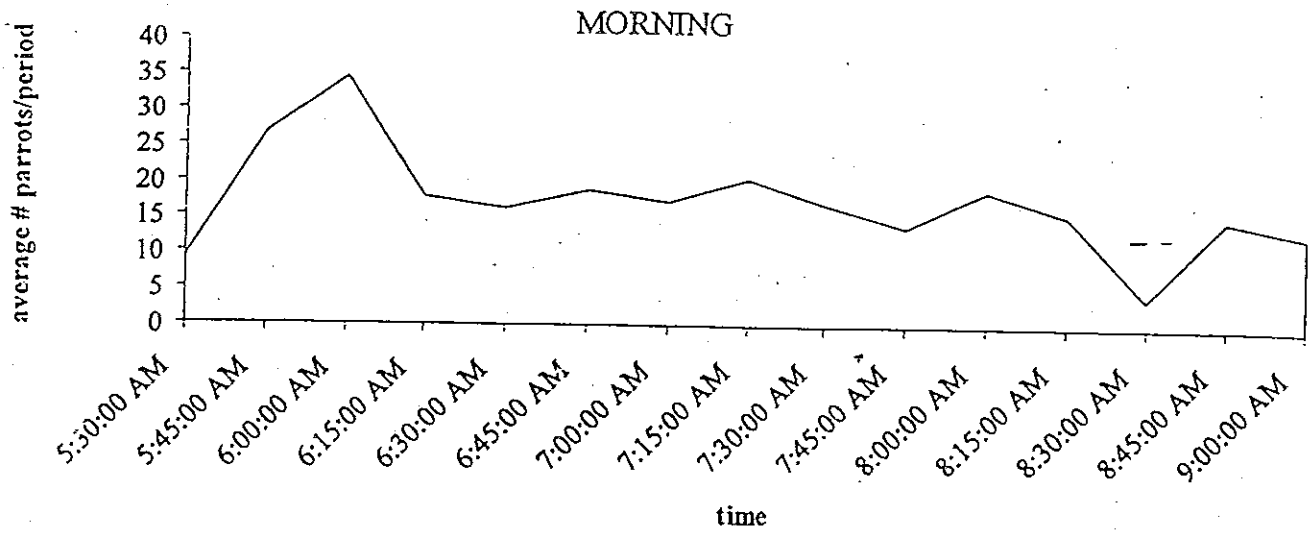
Species Accounts. For each parrot species recorded in Guyana, a species account follows. In each account, the following information is given:

1) The accepted English name (from Sibley and Monroe 1994, although I use Hawk-headed Parrot and not Red-fan Parrot for Deroptyus accipitrinus because this species is commonly known by the former name in most literature dealing with the wildlife trade).

2) Results of this study, including a table showing the results from each survey, organized by stratum. Behavior, nesting behavior, and seasonal trends are discussed. For the most common species, the diurnal timing of observations is discussed.

3) Habitats. Results of habitat use found in this study are given and generally follow the classification scheme used by Huber et al. (1995: see above). Stotz et al (1997) gave information on habitats, elevations, and distribution for all Neotropical bird species. They distinguish 29 terrestrial habitats, of which 13 are found in Guyana; these 13 largely correspond to those used by Huber et al (1995; see p. 20). Habitat use by Neotropical parrots in Guyana and other nearby countries are also given in Snyder (1968), Haverschmidt (1968), Forshaw (1977), Meyer de Schauensee and Phelps (1978), Ridgely (1982), and Desenne and Strahl (1991).

4) Previous reports from Guyana. Snyder (1966) gives a fairly comprehensive treatment of what was known of all bird species in Guyana up until the time of publication. For each species she lists localities of specimen and sight records. In the Iwokrama Mountains, an isolated range in the Terra Firme-North stratum, the Centre for the Study of Biological Diversity, cooperatively run by the Smithsonian Institute (Washington, D. C., USA) and the University of Guyana, have an ongoing project studying forest ecology and



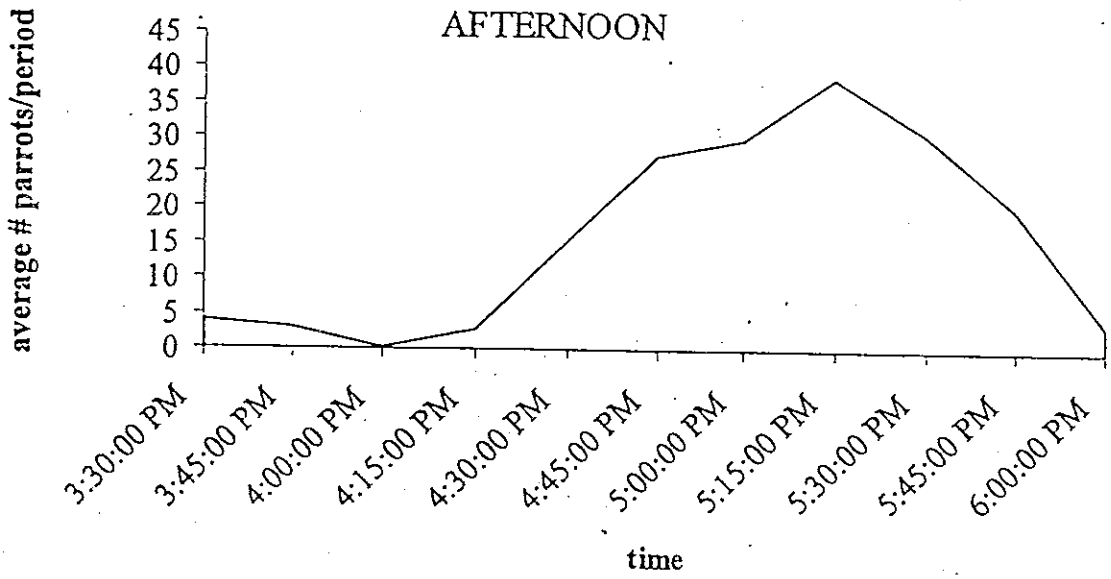


Figure 15. Average number of parrots seen per 15-minute count period from morning counts (left) and afternoon counts (right). Note: only data from March to May period included.

the effects of logging. Data on birds at Iwokrama were provided by D. Agro and R. Ridgely (Philadelphia Academy of Natural Sciences) and M. Robbins (University of Kansas). At the base of this site are terra firme forests (Tall, evergreen non-flooded forests and Tall, evergreen sclerophyllous forest on white sand in the Huber et al. [1995] classification); higher up are terra firme forests (Tall/medium evergreen lower montane forests in the Huber et al. [1995] classification). Another recent source of data is Parker et al (1993), who studied birds in the Kanuku Mountains , an isolated range in the central Rupununi area (Figure 9). This mountain range has dry savanna, gallery forests, and deciduous forests at its base, but is mostly covered by terra firme forests (Tall/medium evergreen lower montane forests in the Huber et al. [1995] classification).

5) Seasonal movements, breeding season. Any seasonal trends in the species distribution in Guyana are discussed. However, this category is probably the least well-known for parrots in Guyana. For many species, Haverschmidt (1968) gives breeding records from Surinam. R. Ridgely and D. Agro (pers. comm.) give some information from breeding records at the Iwokrama Forest Project.

6) Status in nearby countries: In Surinam, Haverschmidt (1968) gives a comprehensive review of the distribution, behavior, ecology, and nesting for all birds known from the country, and Schouten (1995) gives results of a study, including surveys similar to this study, of parrots. Meyer de Schauensee and Phelps (1978) give information on all birds in Venezuela, and Desenne and Strahl (1991) give a more up date overview of the status of parrots. In French Guiana, Thiollay (1991) estimated densities of birds, including several parrot species, on a terra firme forest study plot using a spot-map methodology. Although somewhat out-of-date, Forshaw (1977) gives comprehensive information on parrot species from throughout their distributions. Ridgely (1982) gave an overview of all Neotropical parrots. Stotz et al. (1997) gave an up to date country-by-country distribution of bird species in the Neotropics.

7) Appropriateness of the methodology for censusing. As described above, the appropriateness of the survey methodology employed in this study varies greatly for the different parrot species, depending on the behavior (particularly flight height, flight distances, and vocalization type and frequency), and habitat preferences of parrot species. For each species recorded, I discuss how efficiently the survey methodology encountered the species. However, even if the methodology is efficient at encountering parrots, estimates of density calculated in the ensuing analyses may be overestimated if the birds make long flights (see above).

8) Status of the species in the wildlife export market. For each species, I give the demand for the species on the wildlife export market, the history of exports from Guyana and, if relevant, Surinam, and the current quota. Numbers of birds exported were provided by CITES. The Ministry of Agriculture of Guyana provided current quotas. Demand for the species was learned through interviews with exporters (particularly L. van Sertima) and from individuals interested in the trade in the United States (J. Sailer, pers. comm.)

9) Density and population estimates. Estimates of density and population sizes were calculated for parrot species if there were at least 10 total observations during surveys on a minimum of three counts (see Estimating densities above). For each parrot species for which densities could be estimated, in each stratum the following are given; average flock size, the density estimate with lower and upper 95% confidence interval, and the population estimates with the upper and lower 95% confidence interval. A country-wide sum of the population size is given for the lower 95% confidence interval of the population estimates, because this figure will be used to calculate quotas (see Discussion).

Blue-and-Yellow Macaw

During the March-May surveys, small numbers of Blue-and-Yellow Macaws were found on 11 counts in both strata on the coast (four counts in Region I and two counts in the East Coast) and in one interior stratum (all four count points in the Terra Firme-South stratum). During the September surveys, this species was noted on three of the five surveys in the East Coast Stratum, including 84 on one count (count S5 on Canje Creek; Figure 6). This is a very conspicuous species: they frequently give loud calls, similar to Scarlet Macaw, as they make long direct flights in early mornings and late afternoons above the canopy or along rivers (pers. obs., Forshaw 1977). The census methodology used in this study therefore is appropriate for surveying this species.

The results here indicate that this species' use of coastal plain habitats may vary seasonally (Table 8). Many informants in both the Region I and East Coast strata told me that the numbers of Blue-and Yellow Macaws increased dramatically in June and July, which immediately follows the presumed breeding season On censuses during the March to May period few were recorded on strata on the coastal plain (0.44 /count period in Region I and 0.25/count period in East Coast). Most of these were seen in fairly well-forested areas, although on one count (#26) 17 were recorded flying to a large stand of Ité palms *(Mauritia flexosa)* in a largely agricultural landscape. In September, they were much more abundant in the East Coast stratum (2.31/count period) and most of these were seen flying over a largely agricultural or secondary forest landscape. In addition, they were usually in closely associated pairs during the March to May period; however, during the September surveys, the species was most often noted in groups of three, most likely a mated pair with one young. One large group of 14 individuals on the Canje count were said by a local trapper to be group of young. . In Surinam, Haverschmidt (1968) reported breeding in February and March.

Although we did not record this species in the Terra Firme-North stratum, it appears to occur there in Riparian forests. For example, at the Iwokrama Forest Project it is considered fairly common along rivers (D. Agro & R. Ridgely pers. comm.), although numbers are not high relative to other parts of its distribution. In addition, an informant (pers. comm.) stated that it is easily seen at Apoteri, where the Rupununi River flows into the Essequibo River. In general, this species avoids terra firme forests, except along rivers (Ridgely 1982).

Throughout its range, this species appears to be closely associated with forests in the vicinity of water, particularly where palms are present. Stotz et al. (1997) listed, in decreasing importance, the following habitats for this species: Gallery Forest, Palm Forest, Flooded Forest, and Tropical Evergreen Forest (= terra firme). The Blue-and Yellow Macaw differs in habitat choice from the other two large macaws (Scarlet and Red-and-Green Macaw), which are more closely associated with terra firme forests, although all three may occur together (e.g., counts # 62 and 65 in the Terra Firme-South stratum; see Ridgely 1982).

This monotypic species is distributed from eastern Panama through most of tropical lowland South America east of the Andes (Forshaw 1977). As in Guyana, this is the most abundant large macaw on the coast of Surinam "where undisturbed large forests remain" (Haverschmidt

Table 9. Blue-and-Yellow Macaw survey results. Count periods are 15 minutes. S=September count (all others March-May); *count not used in estimates for density (rain, etc.); **count at repeated point; in density estimates results combined; *** using results from either East Coast April (apr) or East Coast Sept. (spt).

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ count period
EAST COAST APRIL				
1	AM	12	0	0.00
2	AM	12	0	0.00
3	AM	12	0	0.00
30	AM	10	0	0.00
24	AM	10	0	0.00
26	AM	8	17	2.13
27	AM	6	0	0.00
28	AM	2	0	0.00
29	AM	3	2	0.67
total		75	19	0.25
REGION 1				
4	PM	1	0	0.00
5	AM	3	0	0.00
6	AM	5	0	0.00
7	AM	3	0	0.00
8	AM	6	14	2.33
9	PM	1	8	8.00
10	AM	3	0	0.00
11	AM	7	0	0.00
12	PM	5	0	0.00
13	AM	4	20	5.00
14	PM	6	0	0.00
15	AM	6	0	0.00
16	AM	5	0	0.00
17	AM	4	0	0.00
18	PM	7	0	0.00
19	AM	9	0	0.00
20	AM	3	2	0.67
21	AM	5	0	0.00
22	PM	8	0	0.00
23	AM	9	0	0.00
total		100	44	0.44
KAMARANG				
31	PM	5	0	0.00
32	AM	11	0	0.00
33	AM	10	0	0.00
34	AM	9	0	0.00
35	PM	6	0	0.00
36	AM	10	0	0.00
37	PM	6	0	0.00
38	AM	10	0	0.00
39	PM	6	0	0.00
40	AM	8	0	0.00
*41	PM	5	0	0.00
42	AM	6	0	0.00
44	AM	13	0	0.00
45	AM	10	0	0.00
46	AM	11	0	0.00
total		126	0	0.00

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ Count period
EAST COAST SEPT.				
S1	PM	4	0	0.00
S2	AM	6	0	0.00
S3	PM	4	18	4.50
S4	AM	8	2	0.25
S5	AM	6	84	14.00
S10	AM	8	0	0.00
S11	PM	6	0	0.00
total		42	104	2.48
RUPUNUNI SAV.				
47	PM	4	0	0.00
48	AM	7	0	0.00
49	AM	3	0	0.00
50	AM	6	0	0.00
51	PM	6	0	0.00
52	AM	9	0	0.00
53	PM	6	0	0.00
54	AM	3	0	0.00
55	AM	2	0	0.00
56	AM	4	0	0.00
total		50	0	0.00
TERRA FIRME-N				
57	AM	10	0	0.00
58	PM	8	0	0.00
59	AM	10	0	0.00
*60	PM	2	0	0.00
61	PM	4	0	0.00
S6	AM	8	0	0.00
S7	AM	4	0	0.00
S8	AM	4	0	0.00
S9	PM	6	0	0.00
S12	AM	8	0	0.00
*25	PM	11	0	0.00
total		75	0	0.00
TERRA FIRME-S				
62	AM	7	2	0.29
**62	AM	9	7	0.78
63	AM	10	2	0.20
64	PM	5	2	0.40
**64	AM	5	0	0.00
65	PM	4	3	0.75
total		40	16	0.40
overall total***	spt	433	164	0.38

1968). It was formerly common in the Delta Amacuro region of Venezuela (adjacent to Region I in Guyana), but has become "extremely rare," probably from over-harvesting for the wildlife trade (Desenne and Strahl 1991).

This is one the most sought -after of parrots for the wildlife trade. Prices for captive-bred individuals may sell for more than US$ 1000 in the United States and Europe. Although the birds breed well in captivity, there is an ongoing need for wild-caught birds to sustain the genetic health of the captive population.

The high demand for the wildlife trade has undoubtedly led to decreases of some populations of Blue-and Yellow Macaws. However, the expansive range of this species, which contains large areas of relatively untouched habitat (e.g., in the Guianas and Amazonia), and the species' ability to tolerate at least some amount of deforestation have insulated it against large-scale population declines. Large populations in relatively pristine areas, such as those in Guyana, should be able to withstand a small amount of harvesting.

Blue-and-Yellow Macaw exports from Guyana averaged 1625 birds/year from 1981-1992; the highest number was 3317 in 1986. The current quota is 720 birds/year. Recent levels of exportation from Guyana do not seem to have led to large declines in the populations of this species. Large numbers can still be found relatively close to population centers in Guyana (e.g., count S5 on Canje Creek: Figure 6) where birds are currently caught for the wildlife trade. The numbers exported from Surinam (1986-1996 average: 346 birds/year, high of 619 birds in 1994; Table 5) have been smaller than from Guyana (Table 2).

Because some strata had fewer than 10 observations, I combined all strata to yield the detection probability (see Methods). For the East Coast stratum, I used the September results. Blue-and Yellow Macaws apparently do not occur in the western portion of the East Coast stratum (i.e., the cultivated areas and secondary forests from the Mahaicony River west; Figure 6). I therefore used only the area of the eastern portion of the this stratum in calculating the estimated population size (Table 10).

Table 10. Estimated flock sizes, densities, and population sizes of Blue-and-Yellow Macaw in Guyana.

strata	Ave. flock size	stratum area	Density (bds/ km²)	Dens. lower 95%	Dens. upper 95%	Population estimate	Pop. Lower 95%	Pop. Upper 95%
EC*	2.97	8740	41.64	8.35	207.55	363934	72979	1813987
REG1	4.40	9390	6.64	2.13	20.69	62350	20001	194279
KAM		15500	no obs.					
RUP		15300	no obs.					
TFN		85070	no obs.					
TFS	1.75	46590	4.8	1.34	17.29	223632	62431	805541
						sum	155410	

* data from September; area of 8740 km² used (see text)

Scarlet Macaw

This species was found in smaller numbers and was less widespread than the other two large macaws (Blue-and-Yellow Macaw and Red-and-Green Macaw). The total of 49 individuals was spread over seven counts in three interior strata (Kamarang, Terra Firme-South, and Terra Firme-North) during the March to May period; none were recorded during the September period. This species was nearly always noted in singles or pairs. This is a very conspicuous species: they frequently gave loud calls, similar to those of Blue-and-Yellow Macaw, as they make long direct flights in early mornings and late afternoons above the canopy. The census methodology used in this study is therefore appropriate for surveying this species.

This species appears to be closely tied to terra-firme forests (Ridgely 1982) and is not found in the flooded or palm forests preferred by Blue-and Yellow Macaws. No Scarlet Macaws were found on the coastal plain in this study, and this species is not a regular visitor to the region (various informants, pers. comm.), which is dominated by flooded forests or agricultural landscapes. In the interior, this species was only encountered on two counts along rivers, and in these areas the riverine forests formed a narrow (i.e., < 2 km wide) band within a landscape dominated by terra firme forests. Scarlet Macaws, however, largely avoid the hilly terra firme and montane forests preferred by Red-and-Green Macaw (Ridgely 1982). Stotz et al. (1997) listed, in decreasing importance, the following habitats for this species: Tropical Lowland Evergreen Forest (= terra firme), Tropical Deciduous Forest, and Gallery Forest.

As in this study, this species is the considered less common then the other large macaws at the Iwokrama Forest Project (D. Agro and R. Ridgely, pers. comm.). They were reported to be nesting there in November (R. Ridgely, pers. comm.). Parker et al. (1993) encountered "large numbers" of this species in the Kanuku Mountains in the central Rupununi; they list it as common in low elevation forests and uncommon at higher elevation forests. Haverschmidt (1968) stated that this is more a bird of hill forests than the Blue-and-Yellow Macaw. It is locally common in Venezuela (Desenne and Strahl 1991).

The nominate subspecies occurs in Guyana and in humid tropical forests in lowland South America south to eastern Bolivia and central Brazil (Forshaw 1977). Another subspecies occurs in Middle America (Wiedenfield 1994).

This CITES Appendix 1 species requires special exemption from the treaty to export. Although Guyana has an apparently fairly substantial population of this species, an exemption has not been applied for, and no birds have been exported since 1986. From 1981-1985 an average of 39/year were exported from Guyana (Table 2). Neighboring Surinam has the required exemption and small numbers have been recently exported (average of 43/year from 1983-1996; Table 5). It seems likely that some of the Scarlet macaws exported from Surinam originate in Guyana (see illegal trade).

I did not record a sufficient number of Scarlet Macaws to run the DISTANCE software that would generate estimated densities and population sizes.

able 11. Scarlet Macaw survey results. Count periods are 15 minutes. S=September count (all others March-May); *count not used in estimates for density (rain, etc.); **count at repeated point; in density estimates results combined; *** using results from either East Coast April (apr) or East Coast Sept. (spt).

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ count period
EAST COAST APRIL				
1	AM	12	0	0.00
2	AM	12	0	0.00
3	AM	12	0	0.00
30	AM	10	0	0.00
24	AM	10	0	0.00
26	AM	8	0	0.00
27	AM	6	0	0.00
28	AM	2	0	0.00
29	AM	3	0	0.00
total		75	0	0.00
REGION 1				
4	PM	1	0	0.00
5	AM	3	0	0.00
6	AM	5	0	0.00
7	AM	3	0	0.00
8	AM	6	0	0.00
9	PM	1	0	0.00
10	AM	3	0	0.00
11	AM	7	0	0.00
12	PM	5	0	0.00
13	AM	4	0	0.00
14	PM	6	0	0.00
15	AM	6	0	0.00
16	AM	5	0	0.00
17	AM	4	0	0.00
18	PM	7	0	0.00
19	AM	9	0	0.00
20	AM	3	0	0.00
21	AM	5	0	0.00
22	PM	8	0	0.00
23	AM	9	0	0.00
total		100	0	0.00
KAMARANG				
31	PM	5	0	0.00
32	AM	11	0	0.00
33	AM	10	0	0.00
34	AM	9	0	0.00
35	PM	6	5	0.83
36	AM	10	0	0.00
37	PM	6	0	0.00
38	AM	10	0	0.00
39	PM	6	0	0.00
40	AM	8	0	0.00
*41	PM	5	0	0.00
42	AM	6	0	0.00
44	AM	13	0	0.00
45	AM	10	2	0.20
46	AM	11	0	0.00
total		126	7	0.06

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ Count period
EAST COAST SEPT.				
S1	PM	4	0	0.00
S2	AM	6	0	0.00
S3	PM	4	0	0.00
S4	AM	8	0	0.00
S5	AM	6	0	0.00
S10	AM	8	0	0.00
S11	PM	6	0	0.00
total		42	0	0.00
RUPUNUNI SAV.				
47	PM	4	0	0.00
48	AM	7	0	0.00
49	AM	3	0	0.00
50	AM	6	0	0.00
51	PM	6	0	0.00
52	AM	9	0	0.00
53	PM	6	0	0.00
54	AM	3	0	0.00
55	AM	2	0	0.00
56	AM	4	0	0.00
total		50	0	0.00
TERRA FIRME-N				
57	AM	10	8	0.80
58	PM	8	0	0.00
59	AM	10	27	2.70
*60	PM	2	2	1.00
61	PM	4	0	0.00
S6	AM	8	0	0.00
S7	AM	4	0	0.00
S8	AM	4	0	0.00
S9	PM	6	0	0.00
S12	AM	8	0	0.00
*25	PM	11	0	0.00
total		75	37	0.49
TERRA FIRME-S				
62	AM	7	0	0.00
**62	AM	9	3	0.33
63	AM	10	0	0.00
64	PM	5	0	0.00
**64	AM	5	0	0.00
65	PM	4	2	0.50
total		40	5	0.13
overall total***	apr	466	49	0.11

Red-and-Green Macaw

This is the most widespread of the three large macaws (see above). In the March to May period, a total of 112 individuals was seen on 10 counts in interior regions. During the September period, another 28 were recorded on four counts in the Terra Firme-North stratum. Most of the individuals were recorded in terra firme forests at the periphery of the northern Rupununi Savannas. A little less than half the total (64 or 46%) was recorded on one count (#59) and another 21 (14%) were seen on another count (#58) in this area. Like the other large macaws (see above), this species was usually fairly conspicuous as pairs or small groups flew above the canopy or over clearings and rivers and frequently called. The survey methodology is ideal for censusing this species.

This species appears to have somewhat less restrictive habitat requirements than the other two large macaw species. However, during the probable breeding season (approximately January to May according to informants, although R. Ridgely found nesting during October - November [pers. comm.]), which is when the March to May surveys were conducted, this species may be restricted to terra firme or hill forests. The habitat at all survey points where we recorded this species was either terra firme or hill forests (Kamarang, Terra Firme-North) or narrow bands of riparian forests in landscape dominated by terra firme forests (Terra Firme-South, the September counts). It apparently uses flooded and riverine forests in coastal regions only seasonally, in the months (July - October following the breeding season (various informants, pers. comm.)

At the Iwokrama Forest Project, D. Agro and R. Ridgely (pers. comm.) state that this is "by far" the most common large macaw, and consider it common there. In the central Rupununi, Parker et al. (1993) listed this species was fairly common in higher elevation forests in the Kanuku Mountains, but rare in lower elevation forests.

This monotypic species is distributed from eastern Panama through humid tropical forests in lowland South America to southern Bolivia, Paraguay, and northern Argentina (Forshaw 1977). It is locally common in Venezuela (Desenne and Strahl 1991). In Surinam, Haverschmidt (1968) stated that, like the Scarlet Macaw, this is an interior forest species. In French Guiana, the density of Red-and-Green Macaws on study plots not hunted by indigenous people is 6.05 birds/km^2; the density drops precipitously, however, where hunting occurs (Thiollay 1989).

This is one of the most sought-after of Guyana's parrots in the wildlife trade. Captive-bred individuals may be sell for more than US$ 1000 in the United States and Europe. Although the birds breed well in captivity, there is an ongoing need of wild-caught birds to sustain the genetic health of the captive population.

The high demand for the wildlife trade has undoubtedly led to decreases of some populations of this macaw. However, the expansive range of this species, which contains large areas of relatively untouched habitat (e.g., in the Guianas and Amazonia), have so far insulated it

Table 12. Red-and-Green Macaw survey results. Count periods are 15 minutes. S=September count (all others March-May); *count not used in estimates for density (rain, etc.); **count at repeated point; in density estimates results combined; *** using results from either East Coast April (apr) or East Coast Sept. (spt).

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ count period
EAST COAST APRIL				
1	AM	12	0	0.00
2	AM	12	0	0.00
3	AM	12	0	0.00
30	AM	10	0	0.00
24	AM	10	0	0.00
26	AM	8	0	0.00
27	AM	6	0	0.00
28	AM	2	0	0.00
29	AM	3	0	0.00
total		75	0	0.00
REGION 1				
4	PM	1	0	0.00
5	AM	3	0	0.00
6	AM	5	0	0.00
7	AM	3	0	0.00
8	AM	6	0	0.00
9	PM	1	0	0.00
10	AM	3	0	0.00
11	AM	7	0	0.00
12	PM	5	0	0.00
13	AM	4	0	0.00
14	PM	6	0	0.00
15	AM	6	0	0.00
16	AM	5	0	0.00
17	AM	4	0	0.00
18	PM	7	0	0.00
19	AM	9	0	0.00
20	AM	3	0	0.00
21	AM	5	0	0.00
22	PM	8	0	0.00
23	AM	9	0	0.00
total		100	0	0.00
KAMARANG				
31	PM	5	0	0.00
32	AM	11	2	0.18
33	AM	10	4	0.40
34	AM	9	0	0.00
35	PM	6	6	1.00
36	AM	10	0	0.00
37	PM	6	0	0.00
38	AM	10	0	0.00
39	PM	6	0	0.00
40	AM	8	0	0.00
*41	PM	5	0	0.00
42	AM	6	0	0.00
44	AM	13	0	0.00
45	AM	10	2	0.20
46	AM	11	0	0.00

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ Count period
EAST COAST SEPT.				
S1	PM	4	0	0.00
S2	AM	6	0	0.00
S3	PM	4	0	0.00
S4	AM	8	0	0.00
S5	AM	6	0	0.00
S10	AM	8	0	0.00
S11	PM	6	9	1.50
total		42	9	0.32
RUPUNUNI SAV.				
47	PM	4	0	0.00
48	AM	7	0	0.00
49	AM	3	0	0.00
50	AM	6	0	0.00
51	PM	6	0	0.00
52	AM	9	0	0.00
53	PM	6	0	0.00
54	AM	3	0	0.00
55	AM	2	0	0.00
56	AM	4	0	0.00
total		50	0	0.00
TERRA FIRME-N				
57	AM	10	2	0.20
58	PM	8	21	2.63
59	AM	10	64	6.40
*60	PM	2	0	0.00
61	PM	4	8	2.00
S6	AM	8	9	1.13
S7	AM	4	0	0.00
S8	AM	4	0	0.00
S9	PM	6	0	0.00
S12	AM	8	8	1.00
*25	PM	11	0	0.00
total		75	11	1.49
			2	
TERRA FIRME-S				
62	AM	7	0	0.00
**62	AM	9	0	0.00
63	AM	10	1	0.10
64	PM	5	2	0.40
**64	AM	5	0	0.00
65	PM	4	0	0.00
total		40	3	0.08
overall total***	spt	419	138	0.33

against large-scale population declines. Large populations in relatively pristine areas, such as those in Guyana, should be able to withstand a small amount of harvesting.

Red-and-Green Macaw exports from Guyana averaged 1331 birds/year from 1981-1992; the highest number was 2177 in 1986 (Table 2). The current quota is 900 birds. Recent levels of exportation from Guyana do not seem to have led to large declines in the populations of this species. The numbers exported from Surinam (1986-1996 average: 89 birds/year, high of 204 birds in 1994; Table 5) have been smaller than those from Guyana.

Because some strata had fewer than 10 observations, I combined all strata to yield the detection probability (see Methods). The highest density was in the Terra Firme-North stratum (3.71/ km^2), a little bit less than the density found by Thiollay (1989) in French Guiana on unhunted plots (see above).

Table 13. Estimated flock sizes, densities, and population sizes of Red-and-Green Macaw in Guyana.

strata	Ave. flock size	stratum area	Density (bds/ km^2)	Dens. lower 95%	Dens. upper 95%	Population estimate	Pop. Lower 95%	Pop. Upper 95%
EC	2.97	12780	<3 obs.					
REG1	4.40	9390	no obs.					
KAM		15500	0.46	0.13	1.58	7130	2015	24490
RUP		15300	no obs.					
TFN		85070	8.88	3.71	21.26	755422	315610	1808588
TFS	1.75	46590	<3 obs.					
						sum	320467	

Chestnut-fronted Macaw

This species was not recorded during this study. The only definite record from Guyana of Chestnut-fronted Macaw is one specimen and a few encounters by Schomburgk in the early 19th Century (cited from Snyder 1966). The reasons for its scarcity in Guyana are difficult to determine. It is much more common in Surinam (Haverschmidt 1968, Schouten 1995) and in Venezuela (Meyer de Schauensee and Phelps 1979). Nesting in Surinam has been reported in late May (Haverschmidt 1968).

The species if found in humid tropical forests from eastern Panama south through lowland South America to eastern Bolivia and central Brazil (Forshaw 1977). There are two weakly differentiated subspecies (Forshaw 1977); the nominate is expected in Guyana.

The only report of export of this species from Guyana is eight in 1985. It is possible that these were caught outside of Guyana, as several species not known from Guyana (e.g., *Aratinga auricapilla* and *A. acuticauda*) were reported as being exported from Guyana. The species is exported in small numbers from Surinam (average of 112/year from 1981-1996).

Red-bellied Macaw

This was by far the most abundant macaw recorded during this study, although it was much more commonly recorded during the March to May period. A total of 2661 individuals was recorded at 36 survey points (54% of total) in the March to May period, but only 101 were recorded at three counts in the September period. In the March to May period this species was recorded abundantly in the two coastal strata, in the Rupununi Savanna stratum, and in the Terra Firme-South stratum. None were recorded in the hill country of the Kamarang stratum. This species often traveled in fairly large, loosely assembled flocks of up to 75 individuals. However, flock size averaged from 3-11 birds (Table 15). Red-bellied Macaws would often make long direct fights across open terrain, and would frequently give their distinctive calls (pers. obs., Forshaw 1977). The survey methodology was ideally suited for censusing this species. Red-bellied Macaws were recorded at highest numbers from 0545-0615 and again from 1700-1745, with slightly higher numbers during PM surveys.

This species was closely tied to the presence of palms, particularly Ité or Moriche palms. It generally avoided areas of deep forest and seemed most common where Ité Palms dominated gallery forests in rather open country (e.g., in the Rupununi Savannas, or in the wet palm savannas in Region I). It was also common in the sand forests and riverine forests near Georgetown and the savannas at Konashen (Terra Firme-South stratum). Stotz et al. (1997) listed Palm Forests as the primary and Gallery Forests as the secondary habitats for this species; they state that it is "closely associated with *Mauritia* [= Ité] palm swamp." Ridgely (1982) also stated that it is closely associated with *Mauritia* palms.

The reasons for the higher rate of observation during the March-May period are not apparent. No source has reported seasonal shifts in numbers in Guyana or neighboring countries. The dependence of this species on Ité palms (along with that of the Red-shouldered Macaw, which showed the same pattern) suggests that something in the seasonal phenology of this palm species may lead to seasonal shifts in the numbers of this macaw species. Nesting in Guyana is reported to take place between February and May (McLoughlin 1970, cited from Forshaw 1977).

At the Iwokrama Forest Project, it is only rarely seen (D. Agro and R. Ridgely, pers. comm.); this area, however, lacks appropriate habitat, and I recorded this species only infrequently in this stratum (Terra Firme-North) during this study. Haverschmidt (1968) stated that this is a bird of sandy savannas in Surinam. The species is restricted to humid lowlands east of the Andes in South America (south to eastern Bolivia and central Brazil) and in Trinidad (Forshaw 1977).

Demand for the Red-bellied Macaw is small because the birds are hard to keep in captivity (Low 1980). Only small numbers have been historically exported from Guyana (1981-1992 average 673/year; Table 2). Although this species could be considered a habitat specialist (it is largely restricted to habitats with *Mauritia* palms), its abundance and ability to use disturbed landscapes, along with a low demand for the pet trade, have insulated its populations against declines. It seems unlikely that the current small demand for the pet trade

Table 14. Red-bellied Macaw survey results. Count periods are 15 minutes. S=September count (all others March-May); *count not used in estimates for density (rain, etc.); **count at repeated point; in density estimates results combined; *** using results from either East Coast April (apr) or East Coast Sept. (spt).

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ count period
EAST COAST APRIL				
1	AM	12	94	7.83
2	AM	12	321	26.75
3	AM	12	91	7.58
30	AM	10	103	10.30
24	AM	10	18	1.80
26	AM	8	24	3.00
27	AM	6	14	2.33
28	AM	2	2	1.00
29	AM	3	8	2.67
total		75	675	9.00
REGION I				
4	PM	1	21	21.00
5	AM	3	446	148.67
6	AM	5	210	42.00
7	AM	3	0	0.00
8	AM	6	21	3.50
9	PM	1	0	0.00
10	AM	3	0	0.00
11	AM	7	0	0.00
12	PM	5	4	0.80
13	AM	4	9	2.25
14	PM	6	0	0.00
15	AM	6	4	0.67
16	AM	5	0	0.00
17	AM	4	21	5.25
18	PM	7	10	1.43
19	AM	9	56	6.22
20	AM	3	87	29.00
21	AM	5	44	8.80
22	PM	8	8	1.00
23	AM	9	0	0.00
total		100	941	9.41
KAMARANG				
31	PM	5	0	0.00
32	AM	11	0	0.00
33	AM	10	0	0.00
34	AM	9	0	0.00
35	PM	6	0	0.00
36	AM	10	0	0.00
37	PM	6	0	0.00
38	AM	10	0	0.00
39	PM	6	0	0.00
40	AM	8	0	0.00
*41	PM	5	0	0.00
42	AM	6	0	0.00
44	AM	13	0	0.00
45	AM	10	0	0.00
46	AM	11	0	0.00
total		126	0	0.00

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ Count period
EAST COAST SEPT.				
S1	PM	4	0	0.00
S2	AM	6	35	5.83
S3	PM	4	0	0.00
S4	AM	8	13	1.63
S5	AM	6	0	0.00
S10	AM	8	0	0.00
S11	PM	6	0	0.00
total		42	48	1.14
RUPUNUNI SAV.				
47	PM	4	0	0.00
48	AM	7	0	0.00
49	AM	3	14	4.67
50	AM	6	63	10.50
51	PM	6	493	82.17
52	AM	9	3	0.33
53	PM	6	22	3.67
54	AM	3	101	33.67
55	AM	2	0	0.00
56	AM	4	0	0.00
total		50	696	13.92
TERRA FIRME-N				
57	AM	10	0	0.00
58	PM	8	2	0.25
59	AM	10	4	0.40
*60	PM	2	0	0.00
61	PM	4	0	0.00
S6	AM	8	0	0.00
S7	AM	4	0	0.00
S8	AM	4	0	0.00
S9	PM	6	0	0.00
S12	AM	8	0	0.00
*25	PM	11	0	0.00
total		75	6	0.08
TERRA FIRME-S				
62	AM	7	3	0.43
**62	AM	9	0	0.00
63	AM	10	84	8.40
64	PM	5	173	34.60
**64	AM	5	189	37.80
65	PM	4	67	16.75
total		40	516	12.90
overall total***	apr	466	2234	4.79

could endanger populations in Guyana. The current quota is 1500 birds/year. The numbers exported from Surinam (1986-1996 average: 180 birds/year, high of 302 birds in 1993; Table 5) have been less than those from Guyana.

As we had more than 10 observations in every stratum in which this species was recorded, I computed the detection probability separately for each stratum (see Methods). The savannas in the Terra Firme-South stratum where this species was recorded appeared to be restricted to the immediate vicinity of Konashen (pers. obs. from over-flights; see Figure 5). Because this habitat appears to be of limited extent in this stratum, I do not estimate the population size for the stratum as a whole.

Table 15. Estimated flock sizes, densities, and population sizes of Red-bellied Macaw in Guyana.

strata	Ave. flock size	stratum area	Density (bds/ km²)	Dens. lower 95%	Dens. upper 95%	Population estimate	Pop. Lower 95%	Pop. Upper 95%
EC*	2.97	12780	62.35	32.91	118.13	796833	420590	1509701
REG1	4.40	9390	56.43	19.34	164.67	529878	181603	1546251
KAM		15500	no obs.					
RUP		15300	21.96	6.87	70.14	335988	105111	1073142
TFN		85070	1.11	0.08	15.33	94428	6806	1304123
TFS	1.75	46590	46.88	9.3	236.31	**		
						sum**	1147396	

*data from April

** population size not estimated in TFS stratum (see text)

Red-shouldered Macaw

The Red-shouldered Macaw is widespread in rather open habitats in Guyana. A total of 669 individuals was recorded; 611 of these were on 19 counts during the March-May period, and 58 were recorded on four counts in September. It was most abundant on the same counts where large numbers of Red-bellied Macaws were found. More than half (341 or 51%) of the Red-shouldered Macaws were found in the Rupununi Savanna stratum; most others were found in coastal regions, especially in the East Coast stratum during April (2.44 birds/count period). In general, flock size averaged between 4 and 11 (Table 17), but occasional flocks up to 30 individuals were encountered. This species made direct low flights across open areas, and the birds frequently vocalized during flights. The survey methodology was ideally suited for censusing this species.

Because they often occurred on the same counts, Red-shouldered Macaws showed habitat preferences similar to Red-bellied Macaws (see above). Both species also showed the same seasonal pattern: each was more commonly recorded during the March-May period than in September (Table 8) in the East Coast stratum. Red-shouldered Macaws, however, were even less of a forest species than Red-bellied Macaws. They were largely restricted to open areas,

Table 16. Red-shouldered Macaw survey results. Count periods are 15 minutes. S=September count (all others March-May); *count not used in estimates for density (rain, etc.); ** count at repeated point; in density estimates results combined; *** using results from either East Coast April (apr) or East Coast Sept. (spt).

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ count period
EAST COAST APRIL				
1	AM	12	16	1.33
2	AM	12	43	3.58
3	AM	12	24	2.00
30	AM	10	47	4.70
24	AM	10	43	4.30
26	AM	8	8	1.00
27	AM	6	2	0.33
28	AM	2	0	0.00
29	AM	3	0	0.00
total		75	183	2.44
REGION 1				
4	PM	1	0	0.00
5	AM	3	0	0.00
6	AM	5	13	2.60
7	AM	3	0	0.00
8	AM	6	3	0.50
9	PM	1	0	0.00
10	AM	3	0	0.00
11	AM	7	17	2.43
12	PM	5	18	3.60
13	AM	4	0	0.00
14	PM	6	4	0.67
15	AM	6	0	0.00
16	AM	5	0	0.00
17	AM	4	2	0.50
18	PM	7	0	0.00
19	AM	9	0	0.00
20	AM	3	4	1.33
21	AM	5	26	5.20
22	PM	8	0	0.00
23	AM	9	0	0.00
total		100	87	0.87
KAMARANG				
31	PM	5	0	0.00
32	AM	11	0	0.00
33	AM	10	0	0.00
34	AM	9	0	0.00
35	PM	6	0	0.00
36	AM	10	0	0.00
37	PM	6	0	0.00
38	AM	10	0	0.00
39	PM	6	0	0.00
40	AM	8	0	0.00
*41	PM	5	0	0.00
42	AM	6	0	0.00
44	AM	13	0	0.00
45	AM	10	0	0.00
46	AM	11	0	0.00
total		126	0	0.00

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ Count period
EAST COAST SEPT.				
S1	PM	4	28	7.00
S2	AM	6	0	0.00
S3	PM	4	8	2.00
S4	AM	8	0	0.00
S5	AM	6	0	0.00
S10	AM	8	0	0.00
S11	PM	6	0	0.00
total		42	36	0.86
RUPUNUNI SAV.				
47	PM	4	0	0.00
48	AM	7	0	0.00
49	AM	3	21	7.00
50	AM	6	105	17.50
51	PM	6	98	16.33
52	AM	9	20	2.22
53	PM	6	78	13.00
54	AM	3	19	6.33
55	AM	2	0	0.00
56	AM	4	0	0.00
total		50	341	6.82
TERRA FIRME-N				
57	AM	10	0	0.00
58	PM	8	0	0.00
59	AM	10	0	0.00
*60	PM	2	0	0.00
61	PM	4	0	0.00
S6	AM	8	0	0.00
S7	AM	4	6	1.50
S8	AM	4	0	0.00
S9	PM	6	16	2.67
S12	AM	8	0	0.00
*25	PM	11	0	0.00
total		75	22	0.29
TERRA FIRME-S				
62	AM	7	0	0.00
**62	AM	9	0	0.00
63	AM	10	0	0.00
64	PM	5	0	0.00
**64	AM	5	0	0.00
65	PM	4	0	0.00
total		40	0	0.00
overall total***	apr	466	633	1.36

such as wet savannas (e.g., Region I), dry savannas (Rupununi), or areas with large clearings (e.g., agricultural areas near Georgetown), although small numbers occurred in forests along major rivers (e.g., counts S7 and S9 in the Terra Firme-North stratum). Unlike Red-bellied Macaws, no Red-shouldered Macaws were recorded in the small isolated savannas within extensive forests at Konashen (Terra Firme-South stratum). Stotz et al. (1997) listed Palm Forest as the primary habitat and Gallery Forests as the secondary habitat for this species; they state that it is "frequently associated with *Mauritia* [= Ité] palms". Ridgely (1982) stated that it is found in a variety of open habitats, including *Mauritia* palm stands.

The reasons for the higher rate of observation during the March-May period are not apparent. No source has reported seasonal shifts in numbers in Guyana or neighboring countries. The dependence of this species on Ité palms (along with that of the Red-bellied Macaw, which showed the same pattern) suggests that something in the seasonal phenology of this palm species may lead to seasonal shifts in these macaw species in Guyana. In Guyana, nesting is presumed to occur during the February to May dry season (McLoughlin 1970, cited in Forshaw 1977).

Red-shouldered Macaws have not been recorded at the forest-dominated Iwokrama Forest Project (D. Agro & R. Ridgely, pers. comm.), although they were nesting in river-edge forest near Kurupukari on the Essequibo River (R. Ridgely, pers. comm.). Haverschmidt (1968) stated that this species was common in the sandy savannas of Surinam, and sometimes wanders to the coast in September and October.

The species is restricted to tropical lowlands east of the Andes in South America, south to eastern Bolivia and central Brazil; however, it is absent from most of Amazonia, which is heavily forested. Three subspecies are recognized; the nominate is found in Guyana, Venezuela, and northern Brazil (Forshaw 1977).

Like the Red-bellied Macaw, demand for the Red-shouldered Macaw for the pet trade is low. An average of 595 was exported from Guyana between 1981 and 1992 (Table 2). The numbers exported from Surinam (1986-1996 average: 57 birds/year; Table 5) have been smaller than those from Guyana.

As we had more than 10 observations in every stratum in which this species was recorded, I computed the detection probability separately for each stratum (see Methods).

Table 17. Estimated flock sizes, densities, and population sizes of Red-shouldered Macaw in Guyana.

strata	Ave. flock size	stratum area	Density (bds/ km²)	Dens. lower 95%	Dens. upper 95%	Population estimate	Pop. Lower 95%	Pop. Upper 95%
EC*	2.97	12780	34.08	19.95	58.21	435542	254961	743924
REG1	4.40	9390	1.47	0.64	3.4	13803	6010	31926
KAM		15500	no obs.					
RUP		15300	104.2	46.78	232.14	1594260	715734	3551742
TFN		85070	< 3 obs.					
TFS	1.75	46590	no obs.					
						sum*	976705	

*data from April

White-eyed Parakeet

During this study, the White-eyed Parakeet was found only in lowland forests in the vicinity of Konashen (Terra Firme -South stratum). However, it was quite common here and was found at all four survey points in this area. Small flocks (average 8.3; Table 19) were rather conspicuous, calling frequently while flying in fairly loose flocks just above the canopy and often along river-courses. A few flocks were noted skirting the edges of the small savannas in the area. The survey methodology appeared to be appropriate for censusing this species.

Stotz et al.(1997) listed River-edge Forests as the primary habitat, and Gallery Forests, Tropical Lowland Evergreen Forest Edge, and Secondary Forests as secondary habitats. Ridgely (1982) gave similar habitats.

The White-eyed Parakeet is a widely distributed species in tropical South America, with its distribution centered in the Amazon Basin. At some sites (e.g., Amazonian Peru) it may be the most frequently encountered parrot (pers. obs.). The four subspecies recognized by Forshaw (1977) are weakly differentiated. The only expected subspecies in Guyana *is A. l. leucophthalmus*, which ranges from eastern Colombia, eastern Venezuela, and the Guianas south through eastern Bolivia and Brazil to northern Argentina, Paraguay, and Uruguay.

In contrast to its abundance in the Amazon Basin, this species is quite local in northeastern South America, even though appropriate habitat (see above) is widespread. Snyder (1966) listed only one specimen from Guyana, without locality. It is absent at the Iwokrama Forest Project (R. Ridgely & D. Agro, pers. comm.). Parker et al. (1993) did not record it in the Kanuku Mountains in the central Rupununi. It has been recorded near Lethem in the Rupununi Savannas (Schouten 1989). Haverschmidt (1968) stated that it is local in Surinam, and listed a few scattered localities, including one on the coast. In the Guianas, nesting is reported from in February, and the clutch size is three to four eggs. (Penard and Penard 1908, cited from Forshaw 1977).

Table 8. White-eyed Parakeet survey results. Count periods are 15 minutes. S=September count (all others March-May); *count not used in estimates for density (rain, etc.); **count at repeated point; in density estimates results combined; *** using results from either East Coast April (apr) or East Coast Sept. (spt).

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ count period
EAST COAST APRIL				
1	AM	12	0	0.00
2	AM	12	0	0.00
3	AM	12	0	0.00
30	AM	10	0	0.00
24	AM	10	0	0.00
26	AM	8	0	0.00
27	AM	6	0	0.00
28	AM	2	0	0.00
29	AM	3	0	0.00
total		75	0	0.00
REGION 1				
4	PM	1	0	0.00
5	AM	3	0	0.00
6	AM	5	0	0.00
7	AM	3	0	0.00
8	AM	6	0	0.00
9	PM	1	0	0.00
10	AM	3	0	0.00
11	AM	7	0	0.00
12	PM	5	0	0.00
13	AM	4	0	0.00
14	PM	6	0	0.00
15	AM	6	0	0.00
16	AM	5	0	0.00
17	AM	4	0	0.00
18	PM	7	0	0.00
19	AM	9	0	0.00
20	AM	3	0	0.00
21	AM	5	0	0.00
22	PM	8	0	0.00
23	AM	9	0	0.00
total		100	0	0.00
KAMARANG				
31	PM	5	0	0.00
32	AM	11	0	0.00
33	AM	10	0	0.00
34	AM	9	0	0.00
35	PM	6	0	0.00
36	AM	10	0	0.00
37	PM	6	0	0.00
38	AM	10	0	0.00
39	PM	6	0	0.00
40	AM	8	0	0.00
*41	PM	5	0	0.00
42	AM	6	0	0.00
44	AM	13	0	0.00
45	AM	10	0	0.00
46	AM	11	0	0.00
total		126	0	0.00

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ Count period
EAST COAST SEPT.				
S1	PM	4	0	0.00
S2	AM	6	0	0.00
S3	PM	4	0	0.00
S4	AM	8	0	0.00
S5	AM	6	0	0.00
S10	AM	8	0	0.00
S11	PM	6	0	0.00
total		42	0	0.00
RUPUNUNI SAV.				
47	PM	4	0	0.00
48	AM	7	0	0.00
49	AM	3	0	0.00
50	AM	6	0	0.00
51	PM	6	0	0.00
52	AM	9	0	0.00
53	PM	6	0	0.00
54	AM	3	0	0.00
55	AM	2	0	0.00
56	AM	4	0	0.00
total		50	0	0.00
TERRA FIRME-N				
57	AM	10	0	0.00
58	PM	8	0	0.00
59	AM	10	0	0.00
*60	PM	2	0	0.00
61	PM	4	0	0.00
S6	AM	8	0	0.00
S7	AM	4	0	0.00
S8	AM	4	0	0.00
S9	PM	6	0	0.00
S12	AM	8	0	0.00
*25	PM	11	0	0.00
total		75	0	0.00
TERRA FIRME-S				
62	AM	7	0	0.00
**62	AM	9	51	5.67
63	AM	10	20	2.00
64	PM	5	5	1.00
**64	AM	5	11	2.20
65	PM	4	0	0.00
total		40	87	2.18
overall total***	apr	466	87	0.19

Species in the genus *Aratinga* are thought to be vectors for diseases that may infect other more valuable species (e.g., large macaws, amazons) in holding areas (L. van Sertima, pers. comm.). In addition, species in this genus are generally fairly easy to captive-breed. For these reasons, demand for White-eyed Parakeets in the wildlife trade is low. The current quota in Guyana is 300 birds/year. An average of only 5 birds/year was exported from Guyana from 1981-1992 (Table 2), probably because of the restricted distribution of this species in Guyana. However, the species has been exported from Surinam (1986-1996 average: 245 birds/year, high of 468 birds in 1988; Table 5) in much greater numbers than from Guyana.

Table 19. Estimated flock sizes, densities, and population sizes of White-eyed Parakeet in Guyana.

strata	Ave. flock size	stratum area	Density (bds/ km²)	Dens. lower 95%	Dens. upper 95%	Population estimate	Pop. Lower 95%	Pop. Upper 95%
EC	2.97	12780	no obs.					
REG1	4.40	9390	no obs.					
KAM		15500	no obs.					
RUP		15300	no obs.					
TFN		85070	no obs.					
TFS	1.75	46590	13.38	3.81	46.99	623,390	177480	2189600
						sum	177480	

Sun Parakeet

This species was not encountered at all during the 1997 fieldwork and now is close to being extirpated from Guyana. However, a middleman in the northern Rupununi (Randy Gilbert, pers. comm.) stated that he had seen Sun Parakeets in 1997 near Karasabi, in the northern Rupununi of Guyana. Several other sources in the Rupununi area also told me that Sun Parakeets can still be seen in Karasabi, but that this as the only locale in Guyana where they still occur.

This species is restricted to northeastern South America in southern Venezuela (one 19th Century record), eastern Brazil, Surinam, and Guyana (Stotz et al. 1997). Breeding has been reported in February in Surinam (Haverschmidt 1967). Stotz et al. (1997) listed Gallery Forest as the primary habitat and Tropical Lowland Evergreen Forest Edge as a secondary habitat. In Surinam, Haverschmidt (1968) stated that this is a species of the southern savannas and gives a locality where it is common. Forshaw (1977) listed open forests and palm groves as habitats. Although two other closely related species (*A. auricapillus and A. jandaya*) have been considered conspecific with the Sun Parakeet (Forshaw 1977), recent treatments have considered them a superspecies by (e.g., Sibley and Monroe 1990).

This species was apparently common across the Rupununi savannas up until recently. Snyder (1966) listed specimens from several locales in the Rupununi area (Pakaraima Mts., Annai,

Karanambo [the latter locality is listed as "Waranmabo", which is not in gazetteer, but is probably a misspelling of Karanambo, which is in the Rupununi]) and also from the coastal plain (Pomeroon, on the eastern border of Region I). Parker et al. (1993) stated that interviews with locals revealed that this species "once presumably common in the Rupununi Savannas, may now be locally extinct."

Trapping for the wildlife trade has no doubt been a major factor in the virtual disappearance of this species from Guyana (Joseph 1992). However, other factors may also have been important. An average of 216 birds/year were legally exported from Guyana from 1981-1992; the largest number (1362) was exported in 1981 and numbers exported decreased sharply afterwards (only 39 by 1984). However, many locals insist that it was illegally trapped out by Brazilians in the 1970s (R. Ridgely, pers. comm.). Parker et al. (1993) also suggested that over-trapping may be responsible for the decline of this and other parrot species in the savannas. However, a long-time middleman/trapper in the Rupununi (Randy Gilbert, pers. comm.) stated that although trapping had an affect on the decline, mainly because they were easy to trap and they used the same nest sites every year, he also suggested that habitat changes have been important. This species frequently raided cornfields in the Rupununi, but corn is now infrequently grown in this area (pers. comm., pers. obs.).

This species is popular as a pet, and large numbers were probably exported from South America in the last few decades. Although species in the genus *Aratinga* are thought to be vectors for diseases that may infect other more valuable species (e.g., large macaws, amazons) in holding areas (L. van Sertima, pers. comm.), and they are generally fairly easy to breed in captivity, there is probably a steady demand for Sun Parakeets to maintain genetic diversity in captive breeding populations.

Brown-throated Parakeet

This species is fairly widely distributed in open areas in Guyana. During the March-May period, 230 individuals were found at 11 survey points (one in the East Coast, nine in the Rupununi Savanna, and one in Terra-Firme-North strata), and in September 163 were found on four counts in the East Coast stratum (3.76/count period). Aside from the latter stratum, this species was most common in the Rupununi savannas (3.02/count period). It was also common in Georgetown city, where no surveys were conducted. However, this species was absent from any areas with continuous forests, and few or none were recorded from the other three interior strata (one count in Terra Firme-North, none in Kamarang or Terra Firme-South), which are mostly forested. It is absent at the Iwokrama Forest Project (R. Ridgely & D. Agro, pers. comm.), which is nearly entirely forested. As forested habitats cover most of Guyana, Snyder's (1966) statement that this species is the "probably commonest parrot" in Guyana, must have been based on a limited sampling of available habitats.

This species is nearly restricted to open landscapes in Guyana. Flocks (average 5-10 birds; Table 21) of up to 50 individuals were noted making low flights between groups of trees in savanna, or over scrubby or agricultural habitats. The survey methodology was fairly

Table 20. Brown-throated Parakeet survey results. Count periods are 15 minutes. S=September count (all others March-May); *count not used in estimates for density (rain, etc.); **count at repeated point; in density estimates results combined; *** using results from either East Coast April (apr) or East Coast Sept. (spt).

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ count period
EAST COAST APRIL				
1	AM	12	0	0.00
2	AM	12	9	0.75
3	AM	12	0	0.00
30	AM	10	35	3.50
24	AM	10	0	0.00
26	AM	8	0	0.00
27	AM	6	0	0.00
28	AM	2	0	0.00
29	AM	3	0	0.00
total		75	44	0.59
REGION 1				
4	PM	1	0	0.00
5	AM	3	0	0.00
6	AM	5	0	0.00
7	AM	3	0	0.00
8	AM	6	0	0.00
9	PM	1	0	0.00
10	AM	3	0	0.00
11	AM	7	0	0.00
12	PM	5	27	5.40
13	AM	4	0	0.00
14	PM	6	0	0.00
15	AM	6	0	0.00
16	AM	5	0	0.00
17	AM	4	0	0.00
18	PM	7	0	0.00
19	AM	9	0	0.00
20	AM	3	4	1.33
21	AM	5	0	0.00
22	PM	8	0	0.00
23	AM	9	0	0.00
total		100	31	0.31
KAMARANG				
31	PM	5	0	0.00
32	AM	11	0	0.00
33	AM	10	0	0.00
34	AM	9	0	0.00
35	PM	6	0	0.00
36	AM	10	0	0.00
37	PM	6	0	0.00
38	AM	10	0	0.00
39	PM	6	0	0.00
40	AM	8	0	0.00
*41	PM	5	0	0.00
42	AM	6	0	0.00
44	AM	13	0	0.00
45	AM	10	0	0.00
46	AM	11	0	0.00
total		126	0	0.00

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ Count period
EAST COAST SEPT.				
S1	PM	4	123	30.75
S2	AM	6	24	4.00
S3	PM	4	0	0.00
S4	AM	8	14	1.75
S5	AM	6	2	0.33
S10	AM	8	0	0.00
S11	PM	6	0	0.00
total		42	163	3.88
RUPUNUNI SAV.				
47	PM	4	0	0.00
48	AM	7	6	0.86
49	AM	3	2	0.67
50	AM	6	38	6.33
51	PM	6	4	0.67
52	AM	9	0	0.00
53	PM	6	40	6.67
54	AM	3	51	17.00
55	AM	2	4	2.00
56	AM	4	6	1.50
total		50	151	3.02
TERRA FIRME-N				
57	AM	10	0	0.00
58	PM	8	0	0.00
59	AM	10	4	0.40
*60	PM	2	0	0.00
61	PM	4	0	0.00
S6	AM	8	0	0.00
S7	AM	4	0	0.00
S8	AM	4	0	0.00
S9	PM	6	0	0.00
S12	AM	8	0	0.00
*25	PM	11	0	0.00
total		75	4	0.05
TERRA FIRME-S				
62	AM	7	0	0.00
**62	AM	9	0	0.00
63	AM	10	0	0.00
64	PM	5	0	0.00
**64	AM	5	0	0.00
65	PM	4	0	0.00
total		40	0	0.00
overall total***	spt	433	349	0.81

appropriate for this species, although the flight distances were often short, which may lead to over-counting (see above).

Like several other parrot species, there was a marked seasonal difference in the East Coast stratum (Table 8), with many more recorded in September (3.67/period, compared to 0.59 in April). The Brown-throated Parakeet has nested in nearly every month in Surinam (Haverschmidt 1968). The clutch size is from four to seven eggs (Forshaw 1977).

Stotz et al. (1997) listed Tropical Deciduous Forest as the primary habitat and Gallery Forests, White Sand Forests, and Tropical Lowland Evergreen Forest Edge as secondary habitats. Ridgely (1982) listed similar habitats. Parker et al. (1993) listed it as common in savannas at the base of the Kanuku Mountains in the central Rupununi, but absent in forested habitats. Haverschmidt (1968) stated that this is the commonest parakeet (presumably species in *Aratinga, Pyrrhura*, and *Brotogeris*) in Surinam. The Brown-throated Parakeet is widely distributed in lowlands of northeastern South America, Panama, and islands off Venezuela; the subspecies *A. p. chrysophrys* occurs in the interior of Guyana, the subspecies *A. p. surinama* occurs on the coast (Forshaw 1977).

Species in the genus *Aratinga* are thought to be vectors for diseases that may infect other more valuable species (e.g., large macaws, amazons) in holding areas (L. van Sertima, pers. comm.). In addition, species in this genus are generally fairly easy to captive-breed. For these reasons, demand for Brown-throated Parakeets in the wildlife trade is low. The current quota in Guyana is 500 birds/year. An average of 681 birds/year was exported from Guyana from 1981-1992, although few (no more than 40/year) have been exported since 1988 (Table 2). More or less similar numbers have been exported from Surinam (1986-1996 average: 814 birds/year, high of 1500 birds in 1994; Table 5).

Because some strata had fewer than 10 observations, I combined all strata to yield the detection probability (see Methods). Because of this species' low flights and small size (see above), the effective observation distance was less than for larger species. For these reasons I truncated the observation distance to 500 m. The high density figures (lower estimates) found in both the East Coast and Rupununi strata were nearly equal (Table 21).

Table 21. Estimated flock sizes, densities, and population sizes of Brown-throated Parakeet.

strata	Ave. flock size	stratum area	Density (bds/ km²)	Dens. lower 95%	Dens. upper 95%	Population estimate	Pop. Lower 95%	Pop. Upper 95%
EC*	2.97	12780	277.71	62.36	1236.8	3549134	796961	15806304
REG1	4.40	9390	24.78	3.36	182.9	232684	31550	1717431
KAM		15500	no obs.					
RUP		15300	186.64	65.40	532.68	2855592	1000620	8150004
TFN		85070	< 3 obs.					
TFS	1.75	46590	no obs.					
						sum	1829131	

* data from September

Painted Parakeet

This species was only found in well-forested areas in the Terra Firme-North stratum (2 survey points) and in the Terra Firme south stratum (1 survey point). It was uncommonly recorded on surveys in these areas (a total of only 15 individuals were recorded), although several additional flocks were seen during non-survey periods, especially in the Terra Firme-South stratum.

Painted Parakeets were strictly tied to forested habitats. Near Konashen (Terra Firme-South stratum), it was recorded in the narrow band of riverine forest within a landscape dominated by terra firme forests. In the Terra Firme-North stratum, it was recorded flying along the edge of hilly terra firme forests. Stotz et al. (1997) listed only Tropical Lowland Evergreen (= terra firme) Forests and Montane Evergreen Forests as habitats. Ridgely (1982) listed terra firme and varzea (= seasonally flooded) forests. In montane areas of Guyana, this species appears to be replaced by its congener Fiery-shouldered Parakeet (see below), so the Painted Parakeet is probably restricted to lowland areas in Guyana.

Painted Parakeets flew at or below canopy level, in small compact flocks of 5-12 birds. Their low flight, usually within cover, makes them difficult to detect from clearings. Therefore, the survey methodology was inappropriate for censusing this species, as all survey points were placed in openings of some sort.

This species is certainly more widespread and common than this study indicated. It is considered fairly common at the Iwokrama Forest Project (R. Ridgely & D. Agro, pers. comm.). Snyder (1966) listed localities from both the coastal plain (e.g., Abary River in Region V) and inland (e.g., Takuta R., Annai, and Nappi in the Rupununi). Parker et al. (1993) listed it as fairly common in both low and high elevation forests in the Kanuku Mountains in the central Rupununi. In Surinam, Haverschmidt (1968) determined that the species is "not uncommon" in both coastal and interior forests. On a terra firme forest plot in French Guiana, a density of 0.5 pairs/ km^2, or 1 bird/ km^2, was found (Thiollay 1991).

The species, widely distributed in Amazonia and adjacent areas, has a number of distinct subspecies; the nominate subspecies occurs in the Guianas, as well as southern and eastern Venezuela, and northeastern Brazil (Forshaw 1977). Post breeding birds have been collected at The Iwokrama Forest Project in March (R. Ridgely & D. Agro, pers. comm.). In Surinam, nesting has been reported in February (Hellebrekers 1941, cited from Forshaw 1977). Clutch size is three to four eggs (Penard and Penard 1908, cited from Forshaw 1977).

The current quota in Guyana is 300 birds/year. An average of 50 birds/year were exported from Guyana from 1981-1992 and no more than 90 birds (in 1992) have been exported from Guyana in any one year (Table 2). Surinam has exported much greater numbers (1986-1996 average: 305 birds/year; as many as 560 in one year [1987]; Table 5).

There were too few observations to perform the analysis to estimate densities.

Table 22. Painted Parakeet survey results. Count periods are 15 minutes. S=September count (all others March-May); *count not used in estimates for density (rain, etc.); **count at repeated point; in density estimates results combined; *** using results from either East Coast April (apr) or East Coast Sept. (spt).

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ count period
EAST COAST APRIL				
1	AM	12	0	0.00
2	AM	12	0	0.00
3	AM	12	0	0.00
30	AM	10	0	0.00
24	AM	10	0	0.00
26	AM	8	0	0.00
27	AM	6	0	0.00
28	AM	2	0	0.00
29	AM	3	0	0.00
total		75	0	0.00
REGION 1				
4	PM	1	0	0.00
5	AM	3	0	0.00
6	AM	5	0	0.00
7	AM	3	0	0.00
8	AM	6	0	0.00
9	PM	1	0	0.00
10	AM	3	0	0.00
11	AM	7	0	0.00
12	PM	5	0	0.00
13	AM	4	0	0.00
14	PM	6	0	0.00
15	AM	6	0	0.00
16	AM	5	0	0.00
17	AM	4	0	0.00
18	PM	7	0	0.00
19	AM	9	0	0.00
20	AM	3	0	0.00
21	AM	5	0	0.00
22	PM	8	0	0.00
23	AM	9	0	0.00
total		100	0	0.00
KAMARANG				
31	PM	5	0	0.00
32	AM	11	0	0.00
33	AM	10	0	0.00
34	AM	9	0	0.00
35	PM	6	0	0.00
36	AM	10	0	0.00
37	PM	6	0	0.00
38	AM	10	0	0.00
39	PM	6	0	0.00
40	AM	8	0	0.00
*41	PM	5	0	0.00
42	AM	6	0	0.00
44	AM	13	0	0.00
45	AM	10	0	0.00
46	AM	11	0	0.00
total		126	0	0.00

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ Count period
EAST COAST SEPT.				
S1	PM	4	0	0.00
S2	AM	6	0	0.00
S3	PM	4	0	0.00
S4	AM	8	0	0.00
S5	AM	6	0	0.00
S10	AM	8	0	0.00
S11	PM	6	0	0.00
total		42	0	0.00
RUPUNUNI SAV.				
47	PM	4	0	0.00
48	AM	7	0	0.00
49	AM	3	0	0.00
50	AM	6	0	0.00
51	PM	6	0	0.00
52	AM	9	0	0.00
53	PM	6	0	0.00
54	AM	3	0	0.00
55	AM	2	0	0.00
56	AM	4	0	0.00
total		50	0	0.00
TERRA FIRME-N				
57	AM	10	11	1.10
58	PM	8	2	0.25
59	AM	10	0	0.00
*60	PM	2	0	0.00
61	PM	4	0	0.00
S6	AM	8	0	0.00
S7	AM	4	0	0.00
S8	AM	4	0	0.00
S9	PM	6	0	0.00
S12	AM	8	0	0.00
*25	PM	11	0	0.00
total		75	13	0.17
TERRA FIRME-S				
62	AM	7	0	0.00
**62	AM	9	2	0.22
63	AM	10	0	0.00
64	PM	5	0	0.00
**64	AM	5	0	0.00
65	PM	4	0	0.00
total		40	2	0.05
overall total***	apr	466	15	0.03

Fiery-shouldered Parakeet

I found this species only in the higher elevation hill forests of Guyana (31 birds across four points in Kamarang). It was much more common in the Paramakatoi area (Figure 8), where small numbers (ca. 2.5 birds/hour) were encountered as they flew in small flocks (average 3.4 bird) along the edges of mature forests or foraged at canopy level within forest. It was only encountered at sites with mature forest and was never seen to cross large open areas. As with the Painted Parakeet, the survey methodology used in this study is particularly inappropriate for censusing this species.

This species has a very small distribution in the tepui areas of Venezuela, Guyana, and Brazil (Forshaw 1977, Stotz et al. 1997). Stotz et al. (1997) listed Montane Evergreen Forests between 700 and 1800 m as the only habitat of this species. Snyder (1966) listed several specimen sites in the Kamarang and Paramakatoi Regions. Parker et al. (1993) did not record this species in the Kanuku Mountains in the central Rupununi, and it has not been found at the Iwokrama Forest Project (R. Ridgely and D. Agro, pers. comm.). There are two subspecies; the nominate is found in Guyana and adjacent Venezuela (Forshaw 1977).

The current quota in Guyana is 120 birds/year. An average of 9 birds/year were exported from Guyana from 1981-1992 and no more than 50 birds (in 1986) have been exported from Guyana in any one year. None have been exported from Surinam, where it is unknown.

Table 24. Estimated flock sizes, densities, and population sizes of Fiery-shouldered Parakeet in Guyana.

strata	Ave. flock size	stratum area	Density (bds/ km²)	Dens. lower 95%	Dens. upper 95%	Population estimate	Pop. Lower 95%	Pop. Upper 95%
EC	2.97	12780	no obs.					
REG1	4.40	9390	8.65					
KAM		15500	40.16	12.68	127.22	622510	196510	1972000
RUP		15300	no obs.					
TFN		85070	no obs.					
TFS	1.75	46590	no obs.					
						sum	196510	

Table 23. Fiery-shouldered Parakeet survey results. Count periods are 15 minutes. S=September count (all others March-May); *count not used in estimates for density (rain, etc.); **count at repeated point; in density estimates results combined; *** using results from either East Coast April (apr) or East Coast Sept. (spt).

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ count period
EAST COAST APRIL				
1	AM	12	0	0.00
2	AM	12	0	0.00
3	AM	12	0	0.00
30	AM	10	0	0.00
24	AM	10	0	0.00
26	AM	8	0	0.00
27	AM	6	0	0.00
28	AM	2	0	0.00
29	AM	3	0	0.00
total		75	0	0.00
REGION 1				
4	PM	1	0	0.00
5	AM	3	0	0.00
6	AM	5	0	0.00
7	AM	3	0	0.00
8	AM	6	0	0.00
9	PM	1	0	0.00
10	AM	3	0	0.00
11	AM	7	0	0.00
12	PM	5	0	0.00
13	AM	4	0	0.00
14	PM	6	0	0.00
15	AM	6	0	0.00
16	AM	5	0	0.00
17	AM	4	0	0.00
18	PM	7	0	0.00
19	AM	9	0	0.00
20	AM	3	0	0.00
21	AM	5	0	0.00
22	PM	8	0	0.00
23	AM	9	0	0.00
total		100	0	0.00
KAMARANG				
31	PM	5	0	0.00
32	AM	11	4	0.36
33	AM	10	0	0.00
34	AM	9	0	0.00
35	PM	6	0	0.00
36	AM	10	0	0.00
37	PM	6	0	0.00
38	AM	10	0	0.00
39	PM	6	0	0.00
40	AM	8	0	0.00
*41	PM	5	0	0.00
42	AM	6	0	0.00
44	AM	13	8	0.62
45	AM	10	12	1.20
46	AM	11	7	0.64
total		126	31	0.25

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ Count period
EAST COAST SEPT.				
S1	PM	4	0	0.00
S2	AM	6	0	0.00
S3	PM	4	0	0.00
S4	AM	8	0	0.00
S5	AM	6	0	0.00
S10	AM	8	0	0.00
S11	PM	6	0	0.00
total		42	0	0.00
RUPUNUNI SAV.				
47	PM	4	0	0.00
48	AM	7	0	0.00
49	AM	3	0	0.00
50	AM	6	0	0.00
51	PM	6	0	0.00
52	AM	9	0	0.00
53	PM	6	0	0.00
54	AM	3	0	0.00
55	AM	2	0	0.00
56	AM	4	0	0.00
total		50	0	0.00
TERRA FIRME-N				
57	AM	10	0	0.00
58	PM	8	0	0.00
59	AM	10	0	0.00
*60	PM	2	0	0.00
61	PM	4	0	0.00
S6	AM	8	0	0.00
S7	AM	4	0	0.00
S8	AM	4	0	0.00
S9	PM	6	0	0.00
S12	AM	8	0	0.00
*25	PM	11	0	0.00
total		75	0	0.00
TERRA FIRME-S				
62	AM	7	0	0.00
**62	AM	9	0	0.00
63	AM	10	0	0.00
64	PM	5	0	0.00
**64	AM	5	0	0.00
65	PM	4	0	0.00
total		40	0	0.00
overall total***	apr	466	31	0.07

Unidentified Parrotlets

Several flocks of unidentified parrotlets were seen in the Region I stratum (Table x). These were usually too high too visually identify, and I was not quite certain of vocalization differences among the species at the time that I observed these flocks. These large compact flocks flew quite high above the canopy. Most, but probably not all, were Sapphire-rumped Parrotlets, a fairly common species in flooded forests (see below). Some may also have been Lilac-tailed Parrotlets, as a different vocalization was heard from some flocks, but this species is not known to frequent flooded forests (see below). In addition, some may have been Green-rumped Parrotlets, which also may fly quite high in large compact flocks (see below).

Green-rumped Parrotlet

This species was definitely recorded on only three counts in the March-May period and two counts in the September period. However, at least some of the large numbers of unidentified parrotlets recorded in the Region I stratum in April were probably this species (see above). All those recorded during the March-May period were in terra firme forests peripheral to the Rupununi savannas (in the Terra Firme-North stratum). Large tight flocks flew very high above forests and open areas, and the 203 individuals were distributed over only four flocks. In September, small groups of 2-9 birds were seen flying over or foraging in agricultural fields along the east coast. Although they called frequently, their calls are not very audible from the ground when the flocks are high, so they are rather difficult to detect. When in smaller groups, their weak calls and low flights also make them difficult to detect. The count methodology was thus not well suited for censusing this parrot. This species is certainly more common and widespread than indicated by this study.

Stotz et al. (1997) listed Tropical Deciduous Forest as the primary habitat and Gallery Forests, Tropical Lowland Evergreen Forest Edge, and Secondary Forests as secondary habitats. Habitats listed by Ridgely (1982) are semi-open areas, scrub, secondary growth, and forest edge. Haverschmidt (1968) stated that this species is quite common in open country in Surinam.

Nesting in Surinam has been reported in February, June, and August (Haverschmidt 1968). In Trinidad, breeding has been reported in April (Herklots 1961, cited from Forshaw 1977). Up to seven eggs may be found in a clutch (Forshaw 1977).

This species is widespread in northeastern South America (Colombia, Venezuela, Brazil, Venezuela, and the Guianas) and also in Trinidad. It has been successfully introduced on several West Indian islands (Forshaw 1977). There are five recognized subspecies; the nominate is confined to the Guianas (Forshaw 1977).

Table 25. Unidentified Parrotlet survey results. Count periods are 15 minutes. S=September count (all others March-May).

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ count period
EAST COAST APRIL				
1	AM	12	0	0.00
2	AM	12	0	0.00
3	AM	12	0	0.00
30	AM	10	0	0.00
24	AM	10	0	0.00
26	AM	8	0	0.00
27	AM	6	0	0.00
28	AM	2	0	0.00
29	AM	3	0	0.00
total		75	0	0.00
REGION 1				
4	PM	1	0	0.00
5	AM	3	0	0.00
6	AM	5	0	0.00
7	AM	3	0	0.00
8	AM	6	106	17.67
9	PM	1	0	0.00
10	AM	3	20	6.67
11	AM	7	0	0.00
12	PM	5	67	13.40
13	AM	4	50	12.50
14	PM	6	37	6.17
15	AM	6	16	2.67
16	AM	5	25	5.00
17	AM	4	0	0.00
18	PM	7	10	1.43
19	AM	9	13	1.44
20	AM	3	0	0.00
21	AM	5	72	14.40
22	PM	8	0	0.00
23	AM	9	37	4.11
total		100	453	4.53
KAMARANG				
31	PM	5	0	0.00
32	AM	11	0	0.00
33	AM	10	0	0.00
34	AM	9	0	0.00
35	PM	6	0	0.00
36	AM	10	0	0.00
37	PM	6	0	0.00
38	AM	10	0	0.00
39	PM	6	0	0.00
40	AM	8	0	0.00
41	PM	5	0	0.00
42	AM	6	0	0.00
44	AM	13	25	1.92
45	AM	10	0	0.00
46	AM	11	0	0.00
total		126	25	0.20

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ Count period
EAST COAST SEPT.				
S1	PM	4	0	0.00
S2	AM	6	0	0.00
S3	PM	4	0	0.00
S4	AM	8	0	0.00
S5	AM	6	0	0.00
S10	AM	8	0	0.00
S11	PM	6	0	0.00
total		42	0	0.00
RUPUNUNI SAV.				
47	PM	4	0	0.00
48	AM	7	0	0.00
49	AM	3	0	0.00
50	AM	6	0	0.00
51	PM	6	0	0.00
52	AM	9	0	0.00
53	PM	6	0	0.00
54	AM	3	0	0.00
55	AM	2	0	0.00
56	AM	4	0	0.00
total		50	0	0.00
TERRA FIRME-N				
57	AM	10	0	0.00
58	PM	8	0	0.00
59	AM	10	0	0.00
*60	PM	2	0	0.00
61	PM	4	0	0.00
S6	AM	8	0	0.00
S7	AM	4	0	0.00
S8	AM	4	0	0.00
S9	PM	6	0	0.00
S12	AM	8	0	0.00
25	PM	11	0	0.00
total		75	0	0.00
TERRA FIRME-S				
62	AM	7	0	0.00
62	AM	9	0	0.00
63	AM	10	0	0.00
64	PM	5	0	0.00
64	AM	5	0	0.00
65	PM	4	0	0.00
total		40	0	0.00
overall total		508	478	0.94

Table 26. Green-rumped Parrotlet survey results. Count periods are 15 minutes. S=September count (all others March-May); *count not used in estimates for density (rain, etc.); **count at repeated point; in density estimates results combined; *** using results from either East Coast April (apr) or East Coast Sept. (spt).

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ count period
EAST COAST APRIL				
1	AM	12	0	0.00
2	AM	12	0	0.00
3	AM	12	0	0.00
30	AM	10	0	0.00
24	AM	10	0	0.00
26	AM	8	0	0.00
27	AM	6	0	0.00
28	AM	2	0	0.00
29	AM	3	0	0.00
total		75	0	0.00
REGION 1				
4	PM	1	0	0.00
5	AM	3	0	0.00
6	AM	5	0	0.00
7	AM	3	0	0.00
8	AM	6	0	0.00
9	PM	1	0	0.00
10	AM	3	0	0.00
11	AM	7	0	0.00
12	PM	5	0	0.00
13	AM	4	0	0.00
14	PM	6	0	0.00
15	AM	6	0	0.00
16	AM	5	0	0.00
17	AM	4	0	0.00
18	PM	7	0	0.00
19	AM	9	0	0.00
20	AM	3	0	0.00
21	AM	5	0	0.00
22	PM	8	0	0.00
23	AM	9	0	0.00
total		100	0	0.00
KAMARANG				
31	PM	5	0	0.00
32	AM	11	0	0.00
33	AM	10	0	0.00
34	AM	9	0	0.00
35	PM	6	0	0.00
36	AM	10	0	0.00
37	PM	6	0	0.00
38	AM	10	0	0.00
39	PM	6	0	0.00
40	AM	8	0	0.00
*41	PM	5	0	0.00
42	AM	6	0	0.00
44	AM	13	0	0.00
45	AM	10	0	0.00
46	AM	11	0	0.00
total		126	0	0.00

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ Count period
EAST COAST SEPT.				
S1	PM	4	0	0.00
S2	AM	6	9	1.50
S3	PM	4	0	0.00
S4	AM	8	0	0.00
S5	AM	6	5	0.83
S10	AM	8	0	0.00
S11	PM	6	0	0.00
total		42	14	0.33
RUPUNUNI SAV.				
47	PM	4	0	0.00
48	AM	7	0	0.00
49	AM	3	0	0.00
50	AM	6	0	0.00
51	PM	6	0	0.00
52	AM	9	0	0.00
53	PM	6	0	0.00
54	AM	3	0	0.00
55	AM	2	0	0.00
56	AM	4	0	0.00
total		50	0	0.00
TERRA FIRME-N				
57	AM	10	0	0.00
58	PM	8	36	4.50
59	AM	10	105	10.50
*60	PM	2	0	0.00
61	PM	4	62	15.50
S6	AM	8	0	0.00
S7	AM	4	0	0.00
S8	AM	4	0	0.00
S9	PM	6	0	0.00
S12	AM	8	0	0.00
*25	PM	11	0	0.00
total		75	203	2.71
TERRA FIRME-S				
62	AM	7	0	0.00
**62	AM	9	0	0.00
63	AM	10	0	0.00
64	PM	5	0	0.00
**64	AM	5	0	0.00
65	PM	4	0	0.00
total		40	0	0.00
overall total***	spt	433	217	0.50

into open areas to feed on occasion. The normal clutch is three to four eggs (Penard and Penard 1908, cited from Forshaw 1977).

It is considered common in forest at the Iwokrama Forest Project in the Terra Firme-North stratum (D. Agro & R. Ridgely, pers. comm.). Snyder (1966) listed several localities from throughout the coastal plain of Guyana and a few scattered sites in Kamarang and the Rupununi. Parker et al. (1993) listed it as fairly common in lower elevation forests in the Kanuku mountains in the central Rupununi, but it was absent at higher elevations. In Surinam, Haverschmidt (1968) stated that this species is "quite common" in forests, and it has nested there in February, April, November. On a terra firme forest plot in French Guiana, a density of 6.0 pairs/ km², or 12 birds/ km², was found (Thiollay 1991).

Five subspecies are recognized; the nominate subspeciēs occurs in eastern Venezuela, the Guianas, and northernmost Brazil (Forshaw 1977). Other subspecies are found in northern and eastern Brazil.

Demand on the wildlife export market for Golden-winged Parakeets is low. The current quota is 180 birds/year. An average of 46 birds/year were exported from Guyana between 1981 and 1992, and no more than 130 (in 1985) have been exported in one year (Table 2). Surinam has exported much greater numbers (1986-1996 average: 397 birds/year; as many as 687 in one year [1987]; Table 5).

Because some strata had fewer than 10 observations, I combined all strata to yield the detection probability (see Methods). Because of this species' low flights and small size (see above), the effective observation distance was less than for larger species. For these reasons I truncated the observation distance to 500 m. The density calculated for the Terra Firme-North stratum was very high (ca. 32/ km² for lower estimate: Table 28). Densities in the other strata were similar to the density found by in French Guiana (Thiollay 1991).

Table 28. Estimated flock sizes, densities, and population sizes of Golden-winged Parakeet in Guyana.

strata	Ave. flock size	stratum area	Density (bds/ km²)	Dens. lower 95%	Dens. upper 95%	Population estimate	Pop. Lower 95%	Pop. Upper 95%
EC	2.97	12780	no obs.					
REG1	4.40	9390	8.65	3.49	21.43	81224	32771	201228
KAM		15500	15.69	5.20	47.33	243195	80600	733615
RUP		15300	no obs.					
TFN		85070	83.88	32.28	217.92	7135672	2746060	18538454
TFS	1.75	46590	39.40	6.81	227.80	1835646	317278	10613202
						sum	3176709	

Tepui Parrotlet

This species was only noted on one count (#37), when seven flocks totaling 270 individuals passed high above the canopy over the Mazaruni River in Kamarang.

This species has one of the least extensive distributions of any species in this study; it is restricted to highland forests in the vicinity of the tepuis in Venezuela, Brazil, and Guyana (Stotz et al. 1997). Its preferred habitats are Montane Evergreen Forest and Tropical Lowland Evergreen (= terra firme) Forest between 750 and 1850 m (Stotz et al. 1997). Snyder (1966) listed a single record, a specimen from the Kamarang River. Another specimen was collected in the Iwokrama Forest Project at 475 m (University of Guyana specimen) in 1994; D. Agro (pers. comm.) considered it "relatively common" there. It appears that this species may range quite far away from the main tepui highlands into the hilly lowlands of Guyana.

Demand on the wildlife export market for Tepui Parrotlets is apparently nonexistent, and no birds have ever been reported as being exported from Guyana.

There were too few observations to perform the analysis to estimate densities.

Lilac-tailed Parrotlet

This species was definitely recorded only two counts: one flock of 20 was noted on count 22 in the Region I stratum, and one flock of 18 was seen on count S12 in the Terra Firme-North stratum. Both flocks flew swiftly at canopy level through either riparian forests (count 22) or hilly terra firme forest (count S12). Stotz et al. (1997) listed only Tropical Lowland Evergreen (= terra firme) Forests and Montane Evergreen Forests as habitats.

It is considered "regular" in terra firme forests at Iwokrama (R. Ridgely, Agro pers. comm.). In Surinam, Haverschmidt (1968) stated that this species is an irregular wanderer to coastal regions; he also gave a few interior specimen localities.

This monotypic species has a small distribution centered on the coastal plain of northeastern South America (Venezuela, Guyana, and Surinam); it is also found on Trinidad and Tobago (Forshaw 1977). Breeding in Trinidad has been noted in February and March, where five young were found in one nest and six eggs were found in another (Belcher and Snooker 1936, cited from Forshaw 1977).

Demand on the wildlife export market for Seven-colored Parrotlets is apparently quite small, and no birds have ever been reported as being exported from Guyana or Surinam.

There were too few observations to perform the analysis to estimate densities.

Table 29. Tepui Parrotlet survey results. Count periods are 15 minutes. S=September count (all others March-May); *count not used in estimates for density (rain, etc.); **count at repeated point; in density estimates results combined; *** using results from either East Coast April (apr) or East Coast Sept. (spt).

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ count period
EAST COAST APRIL				
1	AM	12	0	0.00
2	AM	12	0	0.00
3	AM	12	0	0.00
30	AM	10	0	0.00
24	AM	10	0	0.00
26	AM	8	0	0.00
27	AM	6	0	0.00
28	AM	2	0	0.00
29	AM	3	0	0.00
total		75	0	0.00
REGION I				
4	PM	1	0	0.00
5	AM	3	0	0.00
6	AM	5	0	0.00
7	AM	3	0	0.00
8	AM	6	0	0.00
9	PM	1	0	0.00
10	AM	3	0	0.00
11	AM	7	0	0.00
12	PM	5	0	0.00
13	AM	4	0	0.00
14	PM	6	0	0.00
15	AM	6	0	0.00
16	AM	5	0	0.00
17	AM	4	0	0.00
18	PM	7	0	0.00
19	AM	9	0	0.00
20	AM	3	0	0.00
21	AM	5	0	0.00
22	PM	8	0	0.00
23	AM	9	0	0.00
total		100	0	0.00
KAMARANG				
31	PM	5	0	0.00
32	AM	11	0	0.00
33	AM	10	0	0.00
34	AM	9	0	0.00
35	PM	6	0	0.00
36	AM	10	0	0.00
37	PM	6	270	45.00
38	AM	10	0	0.00
39	PM	6	0	0.00
40	AM	8	0	0.00
*41	PM	5	0	0.00
42	AM	6	0	0.00
44	AM	13	0	0.00
45	AM	10	0	0.00
46	AM	11	0	0.00
total		126	270	2.14

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ Count period
EAST COAST SEPT.				
S1	PM	4	0	0.00
S2	AM	6	0	0.00
S3	PM	4	0	0.00
S4	AM	8	0	0.00
S5	AM	6	0	0.00
S10	AM	8	0	0.00
S11	PM	6	0	0.00
total		42	0	0.00
RUPUNUNI SAV.				
47	PM	4	0	0.00
48	AM	7	0	0.00
49	AM	3	0	0.00
50	AM	6	0	0.00
51	PM	6	0	0.00
52	AM	9	0	0.00
53	PM	6	0	0.00
54	AM	3	0	0.00
55	AM	2	0	0.00
56	AM	4	0	0.00
total		50	0	0.00
TERRA FIRME-N				
57	AM	10	0	0.00
58	PM	8	0	0.00
59	AM	10	0	0.00
*60	PM	2	0	0.00
61	PM	4	0	0.00
S6	AM	8	0	0.00
S7	AM	4	0	0.00
S8	AM	4	0	0.00
S9	PM	6	0	0.00
S12	AM	8	0	0.00
*25	PM	11	0	0.00
total		75	0	0.00
TERRA FIRME-S				
62	AM	7	0	0.00
**62	AM	9	0	0.00
63	AM	10	0	0.00
64	PM	5	0	0.00
**64	AM	5	0	0.00
65	PM	4	0	0.00
total		40	0	0.00
overall total***	apr	466	270	0.58

Table 30. Lilac-tailed Parrotlet survey results. Count periods are 15 minutes. S=September count (all others March-May); *count not used in estimates for density (rain, etc.); **count at repeated point; in density estimates results combined; *** using results from either East Coast April (apr) or East Coast Sept. (spt).

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ count period
EAST COAST APRIL				
1	AM	12	0	0.00
2	AM	12	0	0.00
3	AM	12	0	0.00
30	AM	10	0	0.00
24	AM	10	0	0.00
26	AM	8	0	0.00
27	AM	6	0	0.00
28	AM	2	0	0.00
29	AM	3	0	0.00
total		75	0	0.00
REGION 1				
4	PM	1	0	0.00
5	AM	3	0	0.00
6	AM	5	0	0.00
7	AM	3	0	0.00
8	AM	6	0	0.00
9	PM	1	0	0.00
10	AM	3	0	0.00
11	AM	7	0	0.00
12	PM	5	0	0.00
13	AM	4	0	0.00
14	PM	6	0	0.00
15	AM	6	0	0.00
16	AM	5	0	0.00
17	AM	4	0	0.00
18	PM	7	0	0.00
19	AM	9	0	0.00
20	AM	3	0	0.00
21	AM	5	0	0.00
22	PM	8	20	2.50
23	AM	9	0	0.00
total		100	20	0.20
KAMARANG				
31	PM	5	0	0.00
32	AM	11	0	0.00
33	AM	10	0	0.00
34	AM	9	0	0.00
35	PM	6	0	0.00
36	AM	10	0	0.00
37	PM	6	0	0.00
38	AM	10	0	0.00
39	PM	6	0	0.00
40	AM	8	0	0.00
*41	PM	5	0	0.00
42	AM	6	0	0.00
44	AM	13	0	0.00
45	AM	10	0	0.00
46	AM	11	0	0.00
total		126	0	0.00

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ Count period
EAST COAST SEPT.				
S1	PM	4	0	0.00
S2	AM	6	0	0.00
S3	PM	4	0	0.00
S4	AM	8	0	0.00
S5	AM	6	0	0.00
S10	AM	8	0	0.00
S11	PM	6	0	0.00
total		42	0	0.00
RUPUNUNI SAV.				
47	PM	4	0	0.00
48	AM	7	0	0.00
49	AM	3	0	0.00
50	AM	6	0	0.00
51	PM	6	0	0.00
52	AM	9	0	0.00
53	PM	6	0	0.00
54	AM	3	0	0.00
55	AM	2	0	0.00
56	AM	4	0	0.00
total		50	0	0.00
TERRA FIRME-N				
57	AM	10	0	0.00
58	PM	8	0	0.00
59	AM	10	0	0.00
*60	PM	2	0	0.00
61	PM	4	0	0.00
S6	AM	8	0	0.00
S7	AM	4	0	0.00
S8	AM	4	0	0.00
S9	PM	6	0	0.00
S12	AM	8	18	2.25
*25	PM	11	0	0.00
total		75	18	0.24
TERRA FIRME-S				
62	AM	7	0	0.00
**62	AM	9	0	0.00
63	AM	10	0	0.00
64	PM	5	0	0.00
**64	AM	5	0	0.00
65	PM	4	0	0.00
total		40	0	0.00
overall total***	apr	466	38	0.08

Sapphire-rumped Parrotlet

This species was not definitely recorded during the study. However, some of the unidentified parrotlets seen in Region I in April (see above) were probably this species. These large groups were seen flying high above flooded forest in compact flocks. Stotz et al. (1997) listed Tropical Lowland Evergreen (= terra firme) Forests and Flooded Evergreen Forests as habitats. Ridgely (1982) stated that it is mainly a varzea (= seasonally flooded) forests species.

It is frequently encountered flying over forests at The Iwokrama Forest Project (D. Agro & R. Ridgely, pers. comm.). In Surinam, Haverschmidt (1968) stated that it is an uncommon species of savanna forests and forests of the sand ridges; it has been reported to breed there in April. On a terra firme forest plot in French Guiana, a density of 0.5 pairs/ km^2, or 1 bird/ km^2, was found (Thiollay 1991).

This species is found in lowlands in southeastern Colombia, southern Venezuela, northern Brazil (north of the Amazon), and the Guianas. The nominate subspecies is found in the eastern part of its distribution (including Guyana); the western populations are considered a separate subspecies (*T. p. viridiceps*) (Forshaw 1977).

Demand on the wildlife export market for Sapphire-rumped Parrotlets is apparently very low, and no birds have ever been reported as being exported from Guyana or Surinam.

Scarlet-shouldered Parrotlet

This species was not recorded during this study. Snyder (1966) listed a few older records from Berbice and south of Georgetown (Coverdon) on the coastal plain. There had been no other records in Guyana until a recent sighting at the Iwokrama Forest Project (B. Whitney, fide R. Ridgely) and near Timehri (D. Agro, pers. comm.). This species was not recorded during this study.

This little-known monotypic species occurs in scattered populations east of the Andes in lowland tropical South America, mainly in the Amazon Basin (Forshaw 1977). Tropical Lowland Evergreen Forest was the only habitat listed for the species by Stotz et al. (1997); Ridgely (1982) added that it will also use varzea (= seasonally flooded) forests.

Demand the wildlife export market for Scarlet-shouldered Parrotlets is apparently nonexistent, and no birds have ever been reported as being exported from Guyana or Surinam.

Black-headed Parrot

This species was found in small numbers scattered on 10 counts in 3 strata (one count in Region I, eight counts in Kamarang, one count in Terra Firme-North) during the March-May period, and on one count (Terra Firme -North) during the September period. Most (35 of 56 total, or 62 %) were found in hilly forests along rivers in the Kamarang stratum, where 0.28 birds/count period were recorded. This species occurred only in well-forested areas, and was usually noted in pairs or small groups (average from 2-4.5; Table 32) that generally kept near the canopy. Flights were usually short and low; they generally kept just over or along the edges of the canopy. Although they are quite noisy and conspicuous, their short flights and preference for heavy cover renders the survey methodology inappropriate for censusing this species.

During this study, this species was recorded in both flooded and terra firme forests. Stotz et al. (1997) listed two habitats for this species: Tropical Lowland Evergreen (= terra firme) Forest and Flooded Evergreen Forest. Ridgely (1982) also listed these habitats, and added that they occasionally use tall secondary growth.

There is little information on nesting of this species. One breeding condition female was among seven birds collected March-May in Surinam (Bangs and Penard 1918, cited from Forshaw 1977). Haverschmidt (1968) found a nest in October in Surinam. Penard and Penard (1908, cited from Forshaw 1977) stated that the clutch size is from two to four eggs.

Parker et al. (1993) listed it as fairly common in low elevation forests in the Kanuku mountains in the central Rupununi; it was absent at higher elevations. At The Iwokrama Forest Project, it is common (D. Agro & R. Ridgely, pers. comm.). In Surinam, Haverschmidt (1968) stated that this species is "quite common" in forests in the sand ridges, in savanna forests, and the forests of the interior. On a terra firme forest plot in French Guiana, a density of 3 birds/ km^2 was found (Thiollay 1991).

There is a steady demand for Black-headed Parrots on the wildlife export market. The current quota is 600 birds/year. An average of 381 birds/year was exported from Guyana between 1981 and 1992, and as many as 805 (in 1984) have been exported in one year (Table 2). Surinam has had similar numbers exported (1986-1996 average: 553 birds/year; as many as 984 in one year [1994]; Table 5).

Because some strata had fewer than 10 observations, I combined all strata to yield the detection probability (see Methods). The density recorded in the Kamarang region was somewhat higher than the density recorded by Thiollay (1991), although the habitats differed (lower montane vs. lowland terra firme forests). The densities recorded in both Terra Firme strata (0.08 and zero) were far lower than found by Thiollay (1991), who used a methodology that was probably better suited for censusing the species.

Table 31. Black-headed Parrot survey results. Count periods are 15 minutes. S=September count (all others March-May); *count not used in estimates for density (rain, etc.); **count at repeated point; in density estimates results combined; *** using results from either East Coast April (apr) or East Coast Sept. (spt).

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ count period
EAST COAST APRIL				
1	AM	12	0	0.00
2	AM	12	0	0.00
3	AM	12	0	0.00
30	AM	10	0	0.00
24	AM	10	0	0.00
26	AM	8	0	0.00
27	AM	6	0	0.00
28	AM	2	0	0.00
29	AM	3	0	0.00
total		75	0	0.00
REGION 1				
4	PM	1	0	0.00
5	AM	3	0	0.00
6	AM	5	0	0.00
7	AM	3	0	0.00
8	AM	6	0	0.00
9	PM	1	0	0.00
10	AM	3	0	0.00
11	AM	7	0	0.00
12	PM	5	0	0.00
13	AM	4	0	0.00
14	PM	6	0	0.00
15	AM	6	0	0.00
16	AM	5	0	0.00
17	AM	4	0	0.00
18	PM	7	0	0.00
19	AM	9	18	2.00
20	AM	3	0	0.00
21	AM	5	0	0.00
22	PM	8	0	0.00
23	AM	9	0	0.00
total		100	18	0.18
KAMARANG				
31	PM	5	0	0.00
32	AM	11	9	0.82
33	AM	10	4	0.40
34	AM	9	7	0.78
35	PM	6	0	0.00
36	AM	10	4	0.40
37	PM	6	0	0.00
38	AM	10	3	0.30
39	PM	6	2	0.33
40	AM	8	0	0.00
*41	PM	5	3	0.60
42	AM	6	3	0.50
44	AM	13	0	0.00
45	AM	10	0	0.00
46	AM	11	0	0.00
total		126	35	0.28

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ Count period
EAST COAST SEPT.				
S1	PM	4	0	0.00
S2	AM	6	0	0.00
S3	PM	4	0	0.00
S4	AM	8	0	0.00
S5	AM	6	0	0.00
S10	AM	8	0	0.00
S11	PM	6	0	0.00
total		42	0	0.00
RUPUNUNI SAV.				
47	PM	4	0	0.00
48	AM	7	0	0.00
49	AM	3	0	0.00
50	AM	6	0	0.00
51	PM	6	0	0.00
52	AM	9	0	0.00
53	PM	6	0	0.00
54	AM	3	0	0.00
55	AM	2	0	0.00
56	AM	4	0	0.00
total		50	0	0.00
TERRA FIRME-N				
57	AM	10	0	0.00
58	PM	8	0	0.00
59	AM	10	0	0.00
*60	PM	2	0	0.00
61	PM	4	0	0.00
S6	AM	8	0	0.00
S7	AM	4	2	0.50
S8	AM	4	0	0.00
S9	PM	6	0	0.00
S12	AM	8	0	0.00
*25	PM	11	1	0.09
total		75	3	0.04
TERRA FIRME-S				
62	AM	7	0	0.00
**62	AM	9	0	0.00
63	AM	10	0	0.00
64	PM	5	0	0.00
**64	AM	5	0	0.00
65	PM	4	0	0.00
total		40	0	0.00
overall total***	apr	466	56	0.12

Table 32. Estimated flock sizes, densities, and population sizes of Black-headed Parakeet in Guyana.

strata	Ave. flock size	stratum area	Density (bds/ km²)	Dens. lower 95%	Dens. upper 95%	Population estimate	Pop. Lower 95%	Pop. Upper 95%
EC	2.97	12780	no obs.					
REG1	4.40	9390	3.74	0.95	14.77	35119	8921	138690
KAM		15500	5.85	2.74	12.48	90675	42470	193440
RUP		15300	no obs.					
TFN		85070	0.73	0.08	6.89	62101	6806	586132
TFS	1.75	46590	no obs.					
						sum	58196	

Caica Parrot

This species was found to be quite uncommon during the surveys. A total of 23 individuals was encountered, spread over one count in the East coast stratum, three counts in the Kamarang, and two counts in the Terra Firme -North stratum. Small flocks (2-4 birds) were noted as they made quick low flights at or below canopy level. They were seen crossing smaller rivers, but not larger openings or rivers. The survey methodology is thus not appropriate for surveying this species.

This species was most frequently encountered (only 0.13 birds /period) in the hilly river-edge forests in the Kamarang region. The only observation in flooded forests was peripheral to the largely agricultural East Coast stratum (count #27). Stotz et al. (1997) listed Tropical Lowland Evergreen (= terra firme) Forests as the only habitat for this species. Ridgely (1982) also listed terra firme forests as the primary habitat, but states that t will occasionally at forest edges.

At The Iwokrama Forest Project, it is considered fairly common to common (D. Agro & R. Ridgely, pers. comm.). Snyder (1966) considered this species "not common, but widespread" and lists several localities scattered throughout the country, but none from Region I. In the central Rupununi, Parker et al. (1993) found this species to be fairly common in higher elevation forests in the Kanuku mountains, but uncommon in lower elevation forests. In Surinam, this species is found in small flocks in interior forests (Haverschmidt 1968). On a terra firme forest plot in French Guiana, a density of 0.5 pairs/ km², or 1 bird/ km², was found (Thiollay 1991).

Demand on the wildlife export market for Caica Parrots is apparently very low, and no birds have ever been reported as being exported from Guyana or Surinam.

There were too few observations to perform the analysis to estimate densities. There appears to be nothing known about the behavior or breeding season of this species (Forshaw 1977).

Table 33. Caica Parrot survey results. Count periods are 15 minutes. S=September count (all others March-May); *count not used in estimates for density (rain, etc.); **count at repeated point; in density estimates results combined; *** using results from either East Coast April (apr) or East Coast Sept. (spt).

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ count period
EAST COAST APRIL				
1	AM	12	0	0.00
2	AM	12	0	0.00
3	AM	12	0	0.00
30	AM	10	0	0.00
24	AM	10	0	0.00
26	AM	8	0	0.00
27	AM	6	4	0.67
28	AM	2	0	0.00
29	AM	3	0	0.00
total		75	4	0.05
REGION 1				
4	PM	1	0	0.00
5	AM	3	0	0.00
6	AM	5	0	0.00
7	AM	3	0	0.00
8	AM	6	0	0.00
9	PM	1	0	0.00
10	AM	3	0	0.00
11	AM	7	0	0.00
12	PM	5	0	0.00
13	AM	4	0	0.00
14	PM	6	0	0.00
15	AM	6	0	0.00
16	AM	5	0	0.00
17	AM	4	0	0.00
18	PM	7	0	0.00
19	AM	9	0	0.00
20	AM	3	0	0.00
21	AM	5	0	0.00
22	PM	8	0	0.00
23	AM	9	0	0.00
total		100	0	0.00
KAMARANG				
31	PM	5	0	0.00
32	AM	11	0	0.00
33	AM	10	0	0.00
34	AM	9	2	0.22
35	PM	6	0	0.00
36	AM	10	0	0.00
37	PM	6	7	1.17
38	AM	10	8	0.80
39	PM	6	0	0.00
40	AM	8	0	0.00
*41	PM	5	0	0.00
42	AM	6	0	0.00
44	AM	13	0	0.00
45	AM	10	0	0.00
46	AM	11	0	0.00
total		126	17	0.13

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ Count period
EAST COAST SEPT.				
S1	PM	4	0	0.00
S2	AM	6	0	0.00
S3	PM	4	0	0.00
S4	AM	8	0	0.00
S5	AM	6	0	0.00
S10	AM	8	0	0.00
S11	PM	6	0	0.00
total		42	0	0.00
RUPUNUNI SAV.				
47	PM	4	0	0.00
48	AM	7	0	0.00
49	AM	3	0	0.00
50	AM	6	0	0.00
51	PM	6	0	0.00
52	AM	9	0	0.00
53	PM	6	0	0.00
54	AM	3	0	0.00
55	AM	2	0	0.00
56	AM	4	0	0.00
total		50	0	0.00
TERRA FIRME-N				
57	AM	10	0	0.00
58	PM	8	0	0.00
59	AM	10	2	0.20
*60	PM	2	0	0.00
61	PM	4	0	0.00
S6	AM	8	0	0.00
S7	AM	4	0	0.00
S8	AM	4	0	0.00
S9	PM	6	0	0.00
S12	AM	8	2	0.25
*25	PM	11	0	0.00
total		75	4	0.05
TERRA FIRME-S				
62	AM	7	0	0.00
**62	AM	9	0	0.00
63	AM	10	0	0.00
64	PM	5	0	0.00
**64	AM	5	0	0.00
65	PM	4	0	0.00
total		40	0	0.00
overall total***	apr	466	25	0.05

Blue-headed Parrot

This species was recorded in all but one stratum (excepting Region I) and a total of 767 individuals was recorded. It was seen at all but one count point in the Kamarang stratum (N=15) and on every survey (N=6) in the Terra Firme-South stratum. Like many other parrot species in Guyana, Blue-headed Parrots may use river-edge and flooded forests on the coastal plain only seasonally. During the March-May period, it was largely restricted to terra firme forests in the interior of Guyana, but during the September period it was common in secondary and patchy riparian forests in the East Coast stratum. The latter stratum had a high rate of observation (4.33/count period) in September, but a much lower rate (0.05/count period) in April (Table 8). Although this species is largely confined to forested areas in Guyana, it is still quite visible and easily counted using the methodology employed in this study. Loose small flocks (average 2-9, Table 35) up to 20 individuals flew quite high above the canopy and often would cross large openings or rivers. Their distinct vocalizations were given frequently in flight. The forested habitats preferred by Blue-headed Parrots in this study, at least during the March-May period, differed somewhat from the more open habitats (River-edge Forest, Gallery Forest, Tropical Lowland Evergreen [= terra firme] Forest Edge, and Secondary Forest) listed for this species by Stotz et al. (1997). In Guyana it seems likely that this species is restricted during the breeding season to terra firme forests, but during the breeding season it spreads out into flooded and disturbed forests on the coastal plain.

How these shifts in habitat use correspond with the nesting phenology of this species is unclear. A nest with three young was found in March along the upper Orinoco River in Venezuela (Cherrie 1916, cited from Forshaw 1977); Haverschmidt (1968) lists an October breeding record from Surinam. A "young bird" was collected in October at The Iwokrama Forest Project.(D. Agro & R. Ridgely, pers. comm.).

Snyder (1966) considered this species "widespread and moderately common" in forests in Guyana. She gave several localities from the coastal plain, as well as many in the interior. It is common at The Iwokrama Forest Project (D. Agro & R. Ridgely, pers. comm.). In the central Rupununi, Parker et al. (1993) found this species to be common in forests at the base of the Kanuku mountains, but uncommon in higher elevation forests. In Surinam this species is common in forests (Haverschmidt 1968). On a terra firme forest plot in French Guiana, a density of 2.5 birds/km^2 was found (Thiollay 1991). Ridgely (1982, p. 3341) stated that this species "...must be one of the most numerous Neotropical parrots."

Three subspecies are recognized (Forshaw 1977); the widespread nominate subspecies, found in lowlands throughout Amazonia and northern South America, occurs in Guyana. Other subspecies occur in coastal Brazil (*P. m. reichenowi*) and from Costa Rica south to northwestern Ecuador (*P. m. rubigularis*).

There is a steady demand for Blue-headed Parrots on the wildlife export market; it is a locally popular pet (Ridgely 1982). The current quota in Guyana is 900 birds/year. An average of 588 birds/year were exported from Guyana between 1981 and 1992, and as many as 1102 (in

Table 34. Blue-headed Parrot survey results. Count periods are 15 minutes. S=September count (all others March-May); *count not used in estimates for density (rain, etc.); **count at repeated point; in density estimates results combined; *** using results from either East Coast April (apr) or East Coast Sept. (spt).

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ count period
EAST COAST APRIL				
1	AM	12	0	0.00
2	AM	12	3	0.25
3	AM	12	0	0.00
30	AM	10	0	0.00
24	AM	10	1	0.10
26	AM	8	0	0.00
27	AM	6	0	0.00
28	AM	2	0	0.00
29	AM	3	0	0.00
total		75	4	0.05
REGION I				
4	PM	1	0	0.00
5	AM	3	0	0.00
6	AM	5	0	0.00
7	AM	3	0	0.00
8	AM	6	0	0.00
9	PM	1	0	0.00
10	AM	3	0	0.00
11	AM	7	0	0.00
12	PM	5	0	0.00
13	AM	4	0	0.00
14	PM	6	0	0.00
15	AM	6	0	0.00
16	AM	5	0	0.00
17	AM	4	0	0.00
18	PM	7	0	0.00
19	AM	9	0	0.00
20	AM	3	0	0.00
21	AM	5	0	0.00
22	PM	8	0	0.00
23	AM	9	0	0.00
total		100	0	0.00
KAMARANG				
31	PM	5	10	2.00
32	AM	11	55	5.00
33	AM	10	20	2.00
34	AM	9	12	1.33
35	PM	6	3	0.50
36	AM	10	17	1.70
37	PM	6	8	1.33
38	AM	10	46	4.60
39	PM	6	31	5.17
40	AM	8	8	1.00
*41	PM	5	0	0.00
42	AM	6	3	0.50
44	AM	13	2	0.15
45	AM	10	37	3.70
46	AM	11	30	2.73
total		126	282	2.24

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ Count period
EAST COAST SEPT.				
S1	PM	4	0	0.00
S2	AM	6	0	0.00
S3	PM	4	70	17.50
S4	AM	8	13	1.63
S5	AM	6	21	3.50
S10	AM	8	61	7.63
S11	PM	6	30	5.00
total		42	195	4.64
RUPUNUNI SAV.				
47	PM	4	0	0.00
48	AM	7	0	0.00
49	AM	3	0	0.00
50	AM	6	2	0.33
51	PM	6	0	0.00
52	AM	9	26	2.89
53	PM	6	0	0.00
54	AM	3	0	0.00
55	AM	2	0	0.00
56	AM	4	0	0.00
total		50	28	0.56
TERRA FIRME-N				
57	AM	10	3	0.30
58	PM	8	1	0.13
59	AM	10	82	8.20
*60	PM	2	2	1.00
61	PM	4	0	0.00
S6	AM	8	0	0.00
S7	AM	4	0	0.00
S8	AM	4	0	0.00
S9	PM	6	8	1.33
S12	AM	8	2	0.25
*25	PM	11	0	0.00
total		75	98	1.31
TERRA FIRME-S				
62	AM	7	17	2.43
**62	AM	9	66	7.33
63	AM	10	50	5.00
64	PM	5	4	0.80
**64	AM	5	17	3.40
65	PM	4	10	2.50
total		40	164	4.10
overall total***	apr	433	767	1.77

1981) have been exported in one year (Table 2). Surinam has had similar numbers exported (1986-1996 average: 467 birds/year; as many as 772 in one year [1990]; Table 5).

Because some strata had fewer than 10 observations, I combined all strata to yield the detection probability (see Methods). Densities in the Terra Firme-South and Kamarang strata (lower estimates, Table 35) were quite a bit higher than those found by Thiollay (1991) in French Guiana, suggesting a possible positive bias in the sampling methodology. Densities in the Terra Firme-North and Rupununi Savanna strata (Table 35) were more similar to the density found by Thiollay (1991). With only the lower population estimates from these latter two strata, the country-wide population is still greater than 200,000 birds.

Table 35. Estimated flock sizes, densities, and population sizes of Blue-headed Parrot in Guyana.

strata	Ave. flock size	stratum area	Density (bds/ km²)	Dens. lower 95%	Dens. upper 95%	Population estimate	Pop. Lower 95%	Pop. Upper 95%
EC*	2.97	12780	51.60	12.84	207.31	659448	164095	2649422
REG1	4.40	9390	no obs.					
KAM		15500	45.73	26.88	77.80	708815	416640	1205900
RUP		15300	3.91	0.61	25.17	59823	9333	385101
TFN		85070	8.90	2.79	28.45	757123	237345	2420242
TFS	1.75	46590	46.25	24.76	86.40	2154788	1153568	4025376
							1980982	

*data from September

Dusky Parrot

This species was found uncommonly during this study. It was widespread however; a total of 72 individuals was scattered across all but one strata (absent only in the Rupununi Savanna). It was found only in well-forested areas where singles, pairs, or small flocks (average 1.5 - 3, Table 36) were observed making short flights below the canopy across smaller rivers or openings. Although the species' low flight and habitat preferences make it difficult to detect, their propensity to frequently vocalize in flight and cross openings probably resulted in an adequate censusing using the survey methodology employed herein.

Stotz et al. (1997) listed only one habitat - Tropical Lowland Evergreen Forest (= terra firme forest) - for this species. Ridgely (1982), however, stated that it occurs found in varzea (= seasonally flooded) as well as terra firme forests, although in fewer numbers in the former. During this study it was recorded in river edge forest and flooded forest, as well as terra firme forests. It was most frequently encountered in the Terra Firme-South stratum (0.60 birds/period), in the narrow band of river-edge forest that snakes through a landscape dominated by terra firme forests. It is only somewhat less common (0.44/period) in the Terra Firme-North stratum. Nearly all of the birds recorded in the Terra Firme-North stratum were during the September surveys, which were all on the coastal plain.

Table 37. Dusky Parrot survey results. Count periods are 15 minutes. S=September count (all others March-May); *count not used in estimates for density (rain, etc.); **count at repeated point; in density estimates results combined; *** using results from either East Coast April (apr) or East Coast Sept. (spt).

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ count period
EAST COAST APRIL				
1	AM	12	0	0.00
2	AM	12	1	0.08
3	AM	12	0	0.00
30	AM	10	0	0.00
24	AM	10	0	0.00
26	AM	8	0	0.00
27	AM	6	0	0.00
28	AM	2	0	0.00
29	AM	3	0	0.00
total		75	1	0.01
REGION 1				
4	PM	1	0	0.00
5	AM	3	0	0.00
6	AM	5	6	1.20
7	AM	3	0	0.00
8	AM	6	0	0.00
9	PM	1	0	0.00
10	AM	3	0	0.00
11	AM	7	0	0.00
12	PM	5	0	0.00
13	AM	4	0	0.00
14	PM	6	0	0.00
15	AM	6	0	0.00
16	AM	5	0	0.00
17	AM	4	5	1.25
18	PM	7	0	0.00
19	AM	9	0	0.00
20	AM	3	0	0.00
21	AM	5	0	0.00
22	PM	8	0	0.00
23	AM	9	1	0.11
total		100	12	0.12
KAMARANG				
31	PM	5	0	0.00
32	AM	11	0	0.00
33	AM	10	0	0.00
34	AM	9	0	0.00
35	PM	6	0	0.00
36	AM	10	0	0.00
37	PM	6	0	0.00
38	AM	10	2	0.20
39	PM	6	0	0.00
40	AM	8	0	0.00
*41	PM	5	0	0.00
42	AM	6	0	0.00
44	AM	13	0	0.00
45	AM	10	0	0.00
46	AM	11	0	0.00
total		126	2	0.02

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ Count period
EAST COAST SEPT.				
S1	PM	4	0	0.00
S2	AM	6	0	0.00
S3	PM	4	3	0.75
S4	AM	8	0	0.00
S5	AM	6	0	0.00
S10	AM	8	0	0.00
S11	PM	6	0	0.00
total		42	3	0.07
RUPUNUNI SAV.				
47	PM	4	0	0.00
48	AM	7	0	0.00
49	AM	3	0	0.00
50	AM	6	0	0.00
51	PM	6	0	0.00
52	AM	9	0	0.00
53	PM	6	0	0.00
54	AM	3	0	0.00
55	AM	2	0	0.00
56	AM	4	0	0.00
total		50	0	0.00
TERRA FIRME-N				
57	AM	10	0	0.00
58	PM	8	0	0.00
59	AM	10	0	0.00
*60	PM	2	0	0.00
61	PM	4	0	0.00
S6	AM	8	2	0.25
S7	AM	4	2	0.50
S8	AM	4	1	0.25
S9	PM	6	13	2.17
S12	AM	8	13	1.63
*25	PM	11	2	0.18
total		75	33	0.44
TERRA FIRME-S				
62	AM	7	9	1.29
**62	AM	9	1	0.11
63	AM	10	1	0.10
64	PM	5	0	0.00
**64	AM	5	0	0.00
65	PM	4	13	3.25
total		40	24	0.60
overall total***	apr	466	72	0.15

Like most other parrots, the nesting period appears to be during the March-May dry season and abundance on the coastal plain may increase following the breeding season. An occupied nest was found in Guyana in the beginning April (Beebe and Beebe 1910, cited from Forshaw 1977). The nest had four young in various states of development. In Surinam, it visits coastal areas in July and August (Haverschmidt 1968).

It is considered common in terra firme forests at The Iwokrama Forest Project (D. Agro & R. Ridgely, pers,. comm.). Snyder (1966) considered this species "moderately common" and listed a number of localities from near the coast (but none in Region I) through the interior. In the central Rupununi, Parker et al. (1993) found this species to be fairly common in higher elevation forests in the Kanuku Mountains, but uncommon in lower elevation forests. This species may be more common in Surinam, where Haverschmidt (1968) stated that it is "common," but "less numerous than *P. menstruus*." On a terra firme forest plot in French Guiana, a density of 2 birds/ km^2 was found (Thiollay 1991).

This monotypic species is confined to the lowlands in northeastern South America (northeastern Colombia, Venezuela, the Guianas and northern Brazil).

There appears to be a steady demand for Dusky Parrots on the wildlife export market; however, there is currently a zero current quota for this species in Guyana. An average of 147 birds/year was exported from Guyana between 1981 and 1992, and as many as 277 (in 1984) have been exported in one year (Table 2). Surinam has had similar numbers exported (1986-1996 average: 173 birds/year; as many as 344 in one year [1990]; Table 5). Unlike Guyana, Surinam currently allows export of Dusky Parrots. Some birds may still be trapped in Guyana and smuggled to Surinam (see illegal trade section above). One trapper said that these birds were "delicate," indicating that they may have high mortality in captivity.

Because some strata had fewer than 10 observations, I combined all strata to yield the detection probability (see Methods). The density figures (lower estimate) found in the two terra firme strata in this study (Table 36) were approximately equal to that found by Thiollay (1991) in similar forests in French Guiana, even though he used different methodology. This concurrence indicates that the survey methodology used in this study gave accurate estimates for this species.

Table 36. Estimated flock sizes, densities, and population sizes of Dusky Parrot in Guyana.

strata	Ave. flock size	stratum area	Density (bds/ km^2)	Dens. lower 95%	Dens. upper 95%	Population estimate	Pop. Lower 95%	Pop. Upper 95%
EC	2.97	12780	< 3 obs.					
REG1	4.40	9390	2.92	0.89	9.6	27419	8357	90144
KAM		15500	0.37	0.07	1.91	5735	1101	29605
RUP		15300	no obs.					
TFN		85070	6.85	2.47	19	582730	210123	1616330
TFS	1.75	46590	13.31	2.84	62.3	620113	132316	2902557
						sum	351896	

Unidentified Amazons

Although the characteristic shallow and quick flaps of Parrots in the genus *Amazona* (often called "Amazons") immediately allow them to be identified to genus, plumage differences among species are slight. For birds flying overhead, it is often difficult to identify them to species based on sight alone. Although *Amazona* parrots are often very vocal and each species has some distinctive vocalizations, many *Amazona* parrots are silent while flying. During the censuses, we recorded silent and/or unidentifiable flying *Amazona* parrots as "Unidentified Amazons." For the analyses, I followed Wiedenfield (1993, 1995) in dispersing these unidentified birds into known *Amazona* species based on the proportion of identified *Amazona* species recorded at that census point. For example, if we recorded 10 Unknown Amazons, 20 Mealy Parrots, and 30 Orange-winged Parrots at a census point, then the proportion of Orange-winged Parrots is 60% (30/50) and 6 of the unknowns (60% of 10 = 6) were added to the Orange-winged Parrot total. Four of the unknowns (40% of 10 = 4) were added to the Mealy Parrot total. The totals with the unidentified birds added are known as "corrected totals." For calculation of densities and populations sizes, I could only disperse unidentified Amazons to known species if only one *Amazona* species was recorded at the census. When more than one *Amazona* species was recorded at a point, it was impossible to assign the unknown observations, which had a required corresponding distance, to known species. Table 38 gives the species to which the unknown Amazon observations were dispersed.

There is a high demand for various *Amazona* species on the wildlife export market. Most species make excellent, long-lived, pets. Problems with captive-breeding (L. van Sertima, pers. comm.), however, have limited the number of captive-reared individuals, and there has been a steady demand for wild-caught individuals. In addition, there is an ongoing need of wild-caught birds to sustain the genetic health of the captive population.

Blue-cheeked Parrot

During this study, Blue-cheeked Parrots were found only in hilly terra firme forests (elevations above 500 m); all were in the Kamarang strata. However, in this region, this species was the most common parrot recorded and was found at 13 of the 15 survey points. This species was nearly always encountered in pairs (Table 40) that flew high above the canopy and called frequently. Large numbers were recorded just after dawn (0545-0600h), and continued until 0745; an average of greater than 10 birds/hour (excluding counts where the species was not recorded) was recorded during all 15-minute periods between 0545-0745h, except one (6.40 birds/hour from 0645-0700). This species was also recorded in high numbers in the afternoon in the Kamarang area (four periods above 10 birds/hour between 1630 and 1745 h). Although this species is more strictly tied to forests than Yellow-crowned or Orange-winged Parrots (see below), Blue-cheeked Parrots are still quite visible and easily counted using the methodology employed in this study. Tightly associated pairs flew quite

Table 38. Unidentified Amazon survey results. Count periods are 15 minutes. S=September count (all others March-May); *Unidentified Amazons dispersed to the following species for "corrected" totals (see text): ow = Orange-winged Parrot; yc=Yellow-crowned Parrot; bc=Blue-cheeked Parrot; me=Mealy Parrot.

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ count period	*dispersed to:
EAST COAST APRIL					
1	AM	12	12	1.00	ow (all)
2	AM	12	0	0.00	
3	AM	12	0	0.00	
30	AM	10	0	0.00	
24	AM	10	2	0.20	ow (all)
26	AM	8	0	0.00	
27	AM	6	4	0.67	ow,yc
28	AM	2	4	2.00	ow (all)
29	AM	3	17	5.67	ow,yc
total		75	39	0.52	
REGION 1					
4	PM	1	8	8.00	ow (all)
5	AM	3	0	0.00	
6	AM	5	5	1.00	me (all)
7	AM	3	0	0.00	
8	AM	6	58	9.67	yc,ow,me
9	PM	1	0	0.00	
10	AM	3	15	5.00	yc,ow
11	AM	7	0	0.00	
12	PM	5	0	0.00	
13	AM	4	17	4.25	yc,ow
14	PM	6	0	0.00	
15	AM	6	0	0.00	
16	AM	5	0	0.00	
17	AM	4	6	1.50	me(all)
18	PM	7	0	0.00	
19	AM	9	0	0.00	
20	AM	3	2	0.67	
21	AM	5	0	0.00	
22	PM	8	5	0.63	ow (all)
23	AM	9	9	1.00	ow (all)
total		100	125	1.25	
KAMARANG					
31	PM	5	0	0.00	
32	AM	11	23	2.09	bc,ow
33	AM	10	22	2.20	bc (all)
34	AM	9	1	0.11	bc (all)
35	PM	6	0	0.00	
36	AM	10	29	2.90	bc,ow
37	PM	6	4	0.67	bc (all)
38	AM	10	6	0.60	bc,ow
39	PM	6	9	1.50	bc,ow
40	AM	8	10	1.25	bc (all)
*41	PM	5	7	1.40	bc (all)
42	AM	6	4	0.67	bc (all)
44	AM	13	0	0.00	
45	AM	10	31	3.10	bc (all)
46	AM	11	31	2.82	bc (all)
total		126	177	1.40	

STRATUM # count	AM or PM	# count periods	# Parrots	Parrots/ count period	*dispersed to:
EAST COAST SEPT.					
S1	PM	4	0	0.00	
S2	AM	6	16	2.67	ow,yc
S3	PM	4	0	0.00	
S4	AM	8	0	0.00	
S5	AM	6	0	0.00	
S10	AM	8	0	0.00	
S11	PM	6	0	0.00	
total		42	16	0.38	
RUPUNUNI SAV.					
47	PM	4	0	0.00	
48	AM	7	0	0.00	
49	AM	3	0	0.00	
50	AM	6	8	1.33	ow,yc
51	PM	6	5	0.83	ow,yc
52	AM	9	16	1.78	ow,yc
53	PM	6	2	0.33	ow,yc
54	AM	3	4	1.33	ow (all)
55	AM	2	0	0.00	
56	AM	4	7	1.75	yc (all)
total		50	42	0.84	
TERRA FIRME-N					
57	AM	10	0	0.00	
58	PM	8	13	1.63	yc,ow
59	AM	10	20	2.00	yc,ow, me
*60	PM	2	0	0.00	
61	PM	4	0	0.00	
S6	AM	8	50	6.25	me,ow
S7	AM	4	0	0.00	
S8	AM	4	0	0.00	
S9	PM	6	15	2.50	
S12	AM	8	6	0.75	me,ow
*25	PM	11	21	1.91	me,ow
total		75	125	1.67	
TERRA FIRME-S					
62	AM	7	0	0.00	
**62	AM	9	0	0.00	
63	AM	10	0	0.00	
64	PM	5	0	0.00	
**64	AM	5	0	0.00	
65	PM	4	0	0.00	
total		40	0	0.00	
overall total		508	524	1.03	

Table 39. Blue-cheeked Parrot survey results. Count periods are 15 minutes. S=September count (all others March-May); *count not used in estimates for density (rain, etc.); **count at repeated point; in density estimates results combined; *** using results from either East Coast April (apr) or East Coast Sept. (spt).

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ count period
EAST COAST APRIL				
1	AM	12	0	0.00
2	AM	12	0	0.00
3	AM	12	0	0.00
30	AM	10	0	0.00
24	AM	10	0	0.00
26	AM	8	0	0.00
27	AM	6	0	0.00
28	AM	2	0	0.00
29	AM	3	0	0.00
total		75	0	0.00
REGION 1				
4	PM	1	0	0.00
5	AM	3	0	0.00
6	AM	5	0	0.00
7	AM	3	0	0.00
8	AM	6	0	0.00
9	PM	1	0	0.00
10	AM	3	0	0.00
11	AM	7	0	0.00
12	PM	5	0	0.00
13	AM	4	0	0.00
14	PM	6	0	0.00
15	AM	6	0	0.00
16	AM	5	0	0.00
17	AM	4	0	0.00
18	PM	7	0	0.00
19	AM	9	0	0.00
20	AM	3	0	0.00
21	AM	5	0	0.00
22	PM	8	0	0.00
23	AM	9	0	0.00
total		100	0	0.00
KAMARANG				
31	PM	5	0	0.00
32	AM	11	62	5.64
33	AM	10	31	3.10
34	AM	9	9	1.00
35	PM	6	11	1.83
36	AM	10	85	8.50
37	PM	6	13	2.17
38	AM	10	6	0.60
39	PM	6	33	5.50
40	AM	8	28	3.50
*41	PM	5	0	0.00
42	AM	6	6	1.00
44	AM	13	15	1.15
45	AM	10	112	11.20
46	AM	11	41	3.73
total		126	452	3.59

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ Count period
EAST COAST SEPT.				
S1	PM	4	0	0.00
S2	AM	6	0	0.00
S3	PM	4	0	0.00
S4	AM	8	0	0.00
S5	AM	6	0	0.00
S10	AM	8	0	0.00
S11	PM	6	0	0.00
total		42	0	0.00
RUPUNUNI SAV.				
47	PM	4	0	0.00
48	AM	7	0	0.00
49	AM	3	0	0.00
50	AM	6	0	0.00
51	PM	6	0	0.00
52	AM	9	0	0.00
53	PM	6	0	0.00
54	AM	3	0	0.00
55	AM	2	0	0.00
56	AM	4	0	0.00
total		50	0	0.00
TERRA FIRME-N				
57	AM	10	0	0.00
58	PM	8	0	0.00
59	AM	10	0	0.00
*60	PM	2	0	0.00
61	PM	4	0	0.00
S6	AM	8	0	0.00
S7	AM	4	0	0.00
S8	AM	4	0	0.00
S9	PM	6	0	0.00
S12	AM	8	0	0.00
*25	PM	11	0	0.00
total		75	0	0.00
TERRA FIRME-S				
62	AM	7	0	0.00
**62	AM	9	0	0.00
63	AM	10	0	0.00
64	PM	5	0	0.00
**64	AM	5	0	0.00
65	PM	4	0	0.00
total		40	0	0.00
overall total***	apr	466	452	0.97

high above the canopy and often would cross large openings or rivers. Their vocalizations were given frequently in flight.

The only habitats of this species listed by Stotz et al. (1997) are Montane Evergreen Forests and Tropical Lowland Evergreen Forests; their elevational range is between 700 and 1700 m. However, Blue-cheeked Parrots use forests below these elevations, at least seasonally, such as the terra firme forests at The Iwokrama Forest Project, where it is considered fairly common (D. Agro & R. Ridgely, pers. comm.). According to informants in Region I (pers. comm.), this species seasonally visits the coastal lowland river-edge and flooded forests following the January to April breeding season. Snyder (1966) stated that this species is "uncommon though widespread in interior forests." She listed several localities on the coastal plain and a few in the Kamarang and Paramakatoi regions. Trappers in the Mazaruni area stated that it is locally common there (Schouten 1989).

This is a little known species (Forshaw 1977, Wege and Collar 1994, Low 1997). Haverschmidt (1968) stated that species is "less numerous" than the Mealy Parrot, and that it visits forests of the sand ridges in the coastal region in July and August. In Venezuela, it is considered uncommon (Desenne and Strahl 1991).

This species has been occasionally considered conspecific *with Amazona rhodocorytha* (e.g., by Forshaw, 1977), a species of eastern Brazil, and both of these were considered conspecific with *A. brasiliensis* of southeastern Brazil by Meyer de Schauensee (1966). Ridgely's treatment (1982) of *A. dufresniana* as a monotypic species is now followed by most authorities (e.g., Sibley and Monroe 1990, CITES).

There is a growing demand for Blue-cheeked Parrots on the wildlife export market. Guyana currently has a quota of zero for this species, but they have been exported in small numbers in the past (1981-1992 average: 45 birds/year, but as many as 133, in 1985; Table 2). Surinam has had small numbers exported recently (1986-1996 average: 19 birds/year; Table 5) and, unlike Guyana, currently allows export of Blue-cheeked Parrots.

The estimated population size (95% lower confidence interval) is above 600,000 birds, all in the Kamarang stratum (Table 40). Seasonal movements probably result in many of these birds descending onto the coastal plain following the dry season (see above).

Table 40. Estimated flock sizes, densities, and population sizes of Blue-cheeked Parrot

strata	Ave. flock size	stratum area	Density (bds/ km²)	Dens. lower 95%	Dens. upper 95%	Population estimate	Pop. Lower 95%	Pop. Upper 95%
EC	2.97	12780	no obs.					
REG1	4.40	9390	no obs.					
KAM		15500	67.76	40.20	114.19	1050200	623130	1770000
RUP		15300	no obs.					
TFN		85070	no obs.					
TFS	1.75	46590	no obs.					
						sum	623130	

Festive Parrot

This species was not recorded during this study. Although the Festive Parrot is definitely known in Guyana only from specimens from the early 19th century (without locale) and the Pomeroon River (eastern border of Region I: Snyder 1966), this species was exported in small numbers in Guyana between 1978 and 1987 (Table 2). It is probably an uncommon, and maybe seasonal, inhabitant of flooded forests in the northwestern parts of Guyana.

Stotz et al. (1997) listed Flooded Evergreen Forest, River-edge Forest, and Gallery Forests as habitats. Ridgely (1982) stated that it is found almost exclusively on river islands and in varzea (= seasonally flooded) forests along major rivers.

There are two recognized subspecies: *A f. bodini* is found only in northwestern Guyana and central Venezuela; the more widespread nominate subspecies occurs in Amazonia from eastern Ecuador and Peru east through central Brazil (Forshaw 1977).

There is a small demand for this species on the wildlife export market. Guyana currently has a zero current quota for this species, but they have been exported in small numbers in the past (1981-1992 average: 68 birds/year, but an anomalous 555 were reported in 1986; Table 2).

Yellow-crowned Amazon

A total of 259 Yellow-crowned Parrots were recorded on 15 counts in three regions (Region I, Berbice, and Rupununi). It was most common in flooded forests on coastal counts in Region I (average 5.76/hour) and Berbice/Corentyne (average 8.2/hour). Pairs and small flocks (average 1.9-5.6; Table 42) were most frequently encountered as they flew quite high above the canopy, making long direct flights across clearings and rivers, and giving their distinctive vocalizations. The survey methodology is well suited for accurate censusing of this species.

Although not as common as the Orange-winged Parrot, the Yellow-crowned Parrot occurs in similar habitats, but it is generally not found in terra firme forests. In decreasing importance, Stotz et al. (1997) listed the following habitats for this species: Flooded Evergreen Forest, River-edge Forest, Gallery Forests, and Tropical Deciduous Forests.

It is not known at The Iwokrama Forest Project (D. Agro & R. Ridgely, pers. comm.), although these ornithologists considered it common at Annai in the Rupununi savanna and on the coast. Snyder (1966) stated that this species is found in wooded areas in Guyana, and is "more common inland than along coast." She listed several localities on the coastal plain and two in the Rupununi. Parker et al. (1993) suggested that this species may be declining in the Rupununi savannas because of over-harvesting for the pet trade. We found that this species was widely distributed in small numbers in the Rupununi. Although coastal regions are the most heavily trapped region for this species, it was still more common in the three coastal regions than in the Rupununi. Like the Orange-winged Parrot, this species is probably

Table 41. Yellow-crowned Parrot survey results. Count periods are 15 minutes. S=September count (all others March-May); *count not used in estimates for density (rain, etc.); **count at repeated point; in density estimates results combined; *** using results from either East Coast April (apr) or East Coast Sept. (spt).

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ count period
EAST COAST APRIL				
1	AM	12	0	0.00
2	AM	12	0	0.00
3	AM	12	0	0.00
30	AM	10	0	0.00
24	AM	10	0	0.00
26	AM	8	18	2.25
27	AM	6	1	0.17
28	AM	2	0	0.00
29	AM	3	20	6.67
total		75	39	0.52
REGION 1				
4	PM	1	0	0.00
5	AM	3	0	0.00
6	AM	5	0	0.00
7	AM	3	0	0.00
8	AM	6	16	2.67
9	PM	1	0	0.00
10	AM	3	49	16.33
11	AM	7	10	1.43
12	PM	5	0	0.00
13	AM	4	69	17.25
14	PM	6	0	0.00
15	AM	6	0	0.00
16	AM	5	0	0.00
17	AM	4	0	0.00
18	PM	7	0	0.00
19	AM	9	0	0.00
20	AM	3	0	0.00
21	AM	5	0	0.00
22	PM	8	0	0.00
23	AM	9	0	0.00
total		100	144	1.44
KAMARANG				
31	PM	5	0	0.00
32	AM	11	0	0.00
33	AM	10	0	0.00
34	AM	9	0	0.00
35	PM	6	0	0.00
36	AM	10	0	0.00
37	PM	6	0	0.00
38	AM	10	0	0.00
39	PM	6	0	0.00
40	AM	8	0	0.00
*41	PM	5	0	0.00
42	AM	6	0	0.00
44	AM	13	0	0.00
45	AM	10	0	0.00
46	AM	11	0	0.00
total		126	0	0.00

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ Count period
EAST COAST SEPT.				
S1	PM	4	0	0.00
S2	AM	6	11	1.83
S3	PM	4	0	0.00
S4	AM	8	0	0.00
S5	AM	6	0	0.00
S10	AM	8	0	0.00
S11	PM	6	0	0.00
total		42	11	0.26
RUPUNUNI SAV.				
47	PM	4	0	0.00
48	AM	7	4	0.57
49	AM	3	0	0.00
50	AM	6	12	2.00
51	PM	6	0	0.00
52	AM	9	11	1.22
53	PM	6	5	0.83
54	AM	3	0	0.00
55	AM	2	0	0.00
56	AM	4	19	4.75
total		50	51	1.02
TERRA FIRME-N				
57	AM	10	0	0.00
58	PM	8	19	2.38
59	AM	10	2	0.20
*60	PM	2	0	0.00
61	PM	4	4	1.00
S6	AM	8	0	0.00
S7	AM	4	0	0.00
S8	AM	4	0	0.00
S9	PM	6	0	0.00
S12	AM	8	0	0.00
*25	PM	11	0	0.00
total		75	25	0.33
TERRA FIRME-S				
62	AM	7	0	0.00
**62	AM	9	0	0.00
63	AM	10	0	0.00
64	PM	5	0	0.00
**64	AM	5	0	0.00
65	PM	4	0	0.00
total		40	0	0.00
overall total***	apr	466	270	0.53

Table 43. Orange-winged Parrot survey results. Count periods are 15 minutes. S=September count (all others March-May); *count not used in estimates for density (rain, etc.); **count at repeated point; in density estimates results combined; *** using results from either East Coast April (apr) or East Coast Sept. (spt).

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ count period
EAST COAST APRIL				
1	AM	12	34	2.83
2	AM	12	2	0.17
3	AM	12	128	10.67
30	AM	10	448	44.80
24	AM	10	3	0.30
26	AM	8	4	0.50
27	AM	6	20	3.33
28	AM	2	21	10.50
29	AM	3	8	2.67
total		75	668	8.91
REGION 1				
4	PM	1	10	10.00
5	AM	3	6	2.00
6	AM	5	13	2.60
7	AM	3	0	0.00
8	AM	6	39	6.50
9	PM	1	0	0.00
10	AM	3	19	6.33
11	AM	7	324	46.29
12	PM	5	7	1.40
13	AM	4	3	0.75
14	PM	6	0	0.00
15	AM	6	0	0.00
16	AM	5	2	0.40
17	AM	4	0	0.00
18	PM	7	0	0.00
19	AM	9	0	0.00
20	AM	3	0	0.00
21	AM	5	0	0.00
22	PM	8	9	1.13
23	AM	9	15	1.67
total		100	447	4.47
KAMARANG				
31	PM	5	0	0.00
32	AM	11	22	2.00
33	AM	10	0	0.00
34	AM	9	0	0.00
35	PM	6	1	0.17
36	AM	10	58	5.80
37	PM	6	0	0.00
38	AM	10	28	2.80
39	PM	6	3	0.50
40	AM	8	6	0.75
*41	PM	5	0	0.00
42	AM	6	0	0.00
44	AM	13	0	0.00
45	AM	10	0	0.00
46	AM	11	0	0.00
total		126	118	0.94

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ Count period
EAST COAST SEPT.				
S1	PM	4	0	0.00
S2	AM	6	15	2.50
S3	PM	4	62	15.50
S4	AM	8	50	6.25
S5	AM	6	11	1.83
S10	AM	8	114	14.25
S11	PM	6	702	117.00
total		42	954	22.71
RUPUNUNI SAV.				
47	PM	4	0	0.00
48	AM	7	0	0.00
49	AM	3	0	0.00
50	AM	6	29	4.83
51	PM	6	17	2.83
52	AM	9	52	5.78
53	PM	6	6	1.00
54	AM	3	6	2.00
55	AM	2	0	0.00
56	AM	4	0	0.00
total		50	110	2.20
TERRA FIRME-N				
57	AM	10	0	0.00
58	PM	8	70	8.75
59	AM	10	106	10.60
*60	PM	2	0	0.00
61	PM	4	16	4.00
S6	AM	8	6	0.75
S7	AM	4	3	0.75
S8	AM	4	2	0.50
S9	PM	6	0	0.00
S12	AM	8	9	1.13
*25	PM	11	42	3.82
total		75	254	3.39
TERRA FIRME-S				
62	AM	7	6	0.86
**62	AM	9	35	3.89
63	AM	10	48	4.80
64	PM	5	41	8.20
**64	AM	5	83	16.60
65	PM	4	6	1.50
total		40	219	5.48
overall total***	apr	433	2102	4.85

Roosts of this species may be immense. Forshaw (1977) describes "many thousands" gong to roost near Georgetown in May 1971. In Surinam, Schouten (1995) counted over 10,000 coming to a single roost on 12 August. It is considered common at The Iwokrama Forest Project (D. Agro & R. Ridgely, pers. comm.). Snyder (1966) listed mainly localities on the coastal plain of Guyana, but also some from the Rupununi. She stated that it is "widespread and abundant." According to Haverschmidt (1968), this is the most numerous parrot in Surinam, living in forests throughout. On a terra firme forest plot in French Guiana, a density 3 birds/ km^2 was found (Thiollay 1991).

Parker et al. (1993) suggested that this species may be declining in the Rupununi savannas because of over-harvesting for the pet trade. We found that this species was still quite common in this region, the average number of birds per period (3.60 birds/period) was only slightly less than the overall average (4.12 birds/period). Furthermore, although this species is much more heavily trapped on the coast than in the Rupununi, it was far more common in on the coast. Local trappers said that this species is quite nomadic in Rupununi and Parker et al.'s team may have been visiting during the wrong season to see many birds on their area. This species usually has the lowest value of any regularly-caught parrot species; therefore, the costs of transportation from the Rupununi to Georgetown make this species less attractive for trapping in the Rupununi savannas (R. Gilbert, pers. comm.).

The widespread nominate subspecies, found in tropical lowlands east of the Andes, occurs in Guyana; a second subspecies of questionable validity occurs in Trinidad and Tobago (Forshaw 1977).

This species has steady demand on the wildlife export market and has always made up the bulk (average of 55% of all parrot exports/year) of the parrots exported from Guyana . The current quota of 9000 birds/year is by far the highest quota for any parrot species. An average of 12,258 birds/year was exported from Guyana between 1981 and 1992, and as many as 16,745 (in 1981) have been exported in one year (Table 2). Surinam has had smaller numbers exported (1986-1996 average: 2140 birds/year; Table 5).

As we had more than 10 observations in every stratum in which this species was recorded, I computed the detection probability separately for each stratum (see Methods). Given the survey results, it is not surprising that this species had the largest estimated population size. Even with the 95% lower population estimate, over 6 million Orange-winged Parrots are estimated for Guyana (Table 44). More than half of these were in the East Coast stratum (from September) and another 30 percent is from the Terra Firme-North stratum. Although figures from other strata were lower, estimated populations in the Terra Firme-South and Rupununi Savannas strata were still greater than 100,000 individuals. The densities found by Thiollay (1991) in a terra firme forest plot were quite a bit lower than found in this study, even for the two terra firme strata.

Table 44. Estimated flock sizes, densities, and population sizes of Orange-winged Parrot in Guyana.

Strata	Ave. flock size	stratum area	Density (bds/ km²)	Dens. lower 95%	Dens. upper 95%	Population estimate	Pop. Lower 95%	Pop. Upper 95%
EC*	2.97	12780	761.00	307.0	1888	9725580	3923460	24128640
REG1	4.40	9390	15.09	4.38	51.98	141695	41128	488092
KAM		15500	6.84	2.36	19.87	106020	36580	307985
RUP		15300	19.52	8.67	43.94	298656	132651	672282
TFN		85070	54.34	21.74	135.82	4622704	1849422	11554207
TFS	1.75	46590	14.03	3.9	50.47	653658	181701	2351397
						sum	6164942	

* data for September

Mealy Parrot

A total of 200 individuals was recorded in forests in three strata (one count in East Coast, eight counts in Region I, and seven counts in Terra Firme-North). This species was most common in the Terra Firme-North stratum (1.61/count period) and was somewhat less common in Region I (0.77/count period). In the former stratum, good numbers were recorded during both the March-May and September survey periods. This species was usually encountered in pairs (average flock size 1.8-2.3; Table 46) that flew quite low above the canopy relative to other species in the genus, often just above the canopy, and called frequently. This species was not seen to make the long high flights that characterized the other species of Amazons recorded during this study. Although the survey methodology may not be as appropriate for this species as the other Amazons, Mealy Parrots are quite noisy and do fly across openings, so the methodology is adequate.

This species is much more tied to lowland forests than the other Amazon parrots recorded during this study (see also Ridgely 1982). At higher elevations it appears to be largely replaced by the Blue-cheeked Parrot in montane forests. In flooded and gallery forests, it is largely replaced by Orange-winged and Yellow-crowned Parrots. Stotz et al. (1997) listed only one habitat; Tropical Lowland Evergreen (= terra firme) Forests, for this species.

The Mealy Parrot is considered common at The Iwokrama Forest Project (D. Agro & R. Ridgely pers. comm.). Parker et al. (1993) encountered "large numbers" of this species in the Kanuku Mountains in the central Rupununi; he lists it as "common" in lower elevation forests, but it was absent at higher elevations in this range. Snyder (1966) stated that this species is "less common" than Orange-winged and Yellow-crowned Parrots, and was found in lowland forests. She listed several localities from the coast and coastal plain, but no interior locales. This species is "rather common" in forests of Surinam (Haverschmidt 1968). On a terra firme forest plot in French Guiana, a density of 3 birds/ km² was found (Thiollay 1991).

Table 45. Mealy Parrot survey results. Count periods are 15 minutes. S=September count (all others March-May); *count not used in estimates for density (rain, etc.); **count at repeated point; in density estimates results combined; *** using results from either East Coast April (apr) or East Coast Sept. (spt).

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ count period
EAST COAST APRIL				
1	AM	12	0	0.00
2	AM	12	2	0.17
3	AM	12	0	0.00
30	AM	10	0	0.00
24	AM	10	0	0.00
26	AM	8	0	0.00
27	AM	6	0	0.00
28	AM	2	0	0.00
29	AM	3	0	0.00
total		75	2	0.03
REGION 1				
4	PM	1	0	0.00
5	AM	3	0	0.00
6	AM	5	0	0.00
7	AM	3	7	2.33
8	AM	6	23	3.83
9	PM	1	0	0.00
10	AM	3	0	0.00
11	AM	7	0	0.00
12	PM	5	2	0.40
13	AM	4	0	0.00
14	PM	6	7	1.17
15	AM	6	6	1.00
16	AM	5	21	4.20
17	AM	4	10	2.50
18	PM	7	0	0.00
19	AM	9	1	0.11
20	AM	3	0	0.00
21	AM	5	0	0.00
22	PM	8	0	0.00
23	AM	9	0	0.00
total		100	77	0.77
KAMARANG				
31	PM	5	0	0.00
32	AM	11	0	0.00
33	AM	10	0	0.00
34	AM	9	0	0.00
35	PM	6	0	0.00
36	AM	10	0	0.00
37	PM	6	0	0.00
38	AM	10	0	0.00
39	PM	6	0	0.00
40	AM	8	0	0.00
*41	PM	5	0	0.00
42	AM	6	0	0.00
44	AM	13	0	0.00
45	AM	10	0	0.00
46	AM	11	0	0.00
total		126	0	0.00

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ Count period
EAST COAST SEPT.				
S1	PM	4	0	0.00
S2	AM	6	0	0.00
S3	PM	4	0	0.00
S4	AM	8	0	0.00
S5	AM	6	0	0.00
S10	AM	8	0	0.00
S11*	PM	6	0	0.00
total		42	0	0.00
RUPUNUNI SAV.				
47	PM	4	0	0.00
48	AM	7	0	0.00
49	AM	3	0	0.00
50	AM	6	0	0.00
51	PM	6	0	0.00
52	AM	9	0	0.00
53	PM	6	0	0.00
54	AM	3	0	0.00
55	AM	2	0	0.00
56	AM	4	0	0.00
total		50	0	0.00
TERRA FIRME-N				
57	AM	10	14	1.40
58	PM	8	0	0.00
59	AM	10	47	4.70
*60	PM	2	0	0.00
61	PM	4	2	0.50
S6	AM	8	25	3.13
S7	AM	4	0	0.00
S8	AM	4	10	2.50
S9	PM	6	0	0.00
S12	AM	8	13	1.63
*25	PM	11	10	0.91
total		75	121	1.61
TERRA FIRME-S				
62	AM	7	0	0.00
**62	AM	9	0	0.00
63	AM	10	0	0.00
64	PM	5	0	0.00
**64	AM	5	0	0.00
65	PM	4	0	0.00
total		40	0	0.00
overall total***	apr	466	200	0.43

A nest from Guyana in a cabbage palm had three young, one of which was much smaller than the other two (McLoughlin 1970, cited from Forshaw 1977). However, no nesting dates are available for the Guianas.

Five subspecies are recognized of this widely distributed species, which is found in lowland forests from southern Mexico south through the Gulf slope of Central America, to northwestern Ecuador, eastern Bolivia, and southern Brazil (Forshaw 1977). The widespread nominate subspecies is found in Guyana and through most of Amazonia.

This species has a high demand on the wildlife export market. The current quota in Guyana is 1000 birds/year. An average of 1653 birds/year were exported from Guyana between 1981 and 1992, and as many as 2598 (in 1981) have been exported in one year (Table 2). Surinam has had smaller numbers exported (1986-1996 average: 96 birds/year; Table 5).

As we had more than 10 observations in every stratum in which we recorded sufficient numbers of observations, I computed the detection probability separately for each stratum (see Methods). From these results, about 94 % of the estimated population occurs in the Terra Firme-North stratum (Table 46). However, some of this population may disperse seasonally into the East Coast and Region I strata (see above). The density estimate of Thiollay (1991) for terra forest in French Guiana (3/ km^2) is a bit lower than found in similar forests in this study (5 km^2: Table 46). However, even using the Thiollay density, a population of 255,500 is estimated for the Terra Firme-North stratum.

Table 46. Estimated flock sizes, densities, and population sizes of Mealy Parrot in Guyana.

strata	Ave. flock size	stratum area	Density (bds/ km^2)	Dens. lower 95%	Dens. upper 95%	Population estimate	Pop. Lower 95%	Pop. Upper 95%
EC*	2.97	12780	< 3 obs.					
REG1	4.40	9390	6.68	2.73	16.35	62725	25635	153527
KAM		15500	no obs.					
RUP		15300	no obs.					
TFN		85070	10.7	5.09	22.46	910249	433006	1910672
TFS	1.75	46590	no obs.					
						sum	458641	

* data for April

Hawk-headed Parrot

During the March to May period, the Hawk-headed Parrot was found on only five counts, all in interior strata (Kamarang, Terra Firme-South, and Terra Firme-North counts at the periphery of the Rupununi savannas). They were recorded on one count in September (in the Terra Firme-North Stratum) and were observed twice more in this area during non-census

periods. A total of only 26 individuals was recorded during surveys; 17 (65%) of these were in the Terra-Firme-North stratum. .

All individuals were seen in mature forest, usually in terra firme forests (all recorded individuals in Rupununi) or along well-developed riverine forests with terra firme forest in close proximity (Kamarang, Terra- Firme-South). Small flocks (up to 5 individuals) flew low over the canopy. The birds were sometimes quite noisy, but silent individuals or groups were also observed. Although they were seen crossing rivers and roads, the flights never strayed far from tall forests, and the flights were short. Therefore, this species was difficult to detect using the survey methodology. Forshaw (1977) stated that this species flies low, rarely above the canopy, in pairs and small flocks up to 20 individuals. Stotz et al. (1997) gave Tropical Lowland Evergreen (= terra firme) Forest as the primary habitat, and River-edge Forest as a secondary habitat.

The Hawk-headed Parrot is considered common at The Iwokrama Forest Project (D. Agro & R. Ridgely pers. comm.). One trapper said they are scarce in hill forests in Region I (part of the Terra Firme -North stratum, Figure 7). Parker et al. (1993) encountered "large numbers" of this species in the Kanuku Mountains in the central Rupununi; he lists it as "common" in lower elevation forests, but it was absent at higher elevations in this range. Snyder (1966) stated that his species is "uncommon in forest" in Guyana. She listed several localities from coastal rivers (but not in Region I), Kamarang, the central Rupununi, and the Acari Mountains on the southern border with Brazil. Like other parrot species in Guyana (Table 8) Hawk-headed Parrots may use coastal plain and river-edge Forests during the post-breeding season (R. Gilbert, pers comm.), which would explain its absence in Region I during this study.

Like most other parrots, the nesting period appears to be during Guyana's March-May dry season. An occupied nest was found in Guyana on 13 March (McLoughlin 1970, cited from Forshaw 1977). Nests in Surinam have been reported in April (Haverschmidt 1989).

There are two subspecies. The nominate occurs in north of the Amazon from southeast Colombia and northeastern Peru east to the Guianas and eastern Brazil; the other is restricted to eastern Amazonian Brazil south of the Amazon. In Surinam, this species is common in forests of the sand ridges, the savanna forests, and the interior (Haverschmidt 1968). It is considered rare and local in Venezuela (Desenne and Strahl 1991). On a terra firme forest plot in French Guiana, a density of 1.5 pairs/ km^2, or 3 birds/ km^2, was found (Thiollay 1991).

There is a high demand for Hawk-headed Parrots on the wildlife export market (Ridgely 1982). Guyana currently has a zero current quota for this species, but they have been exported in moderate numbers in the past (1981-1992 average: 298 birds/year, but as many as 619, in 1986; Table 2). Surinam has had small numbers exported recently (1986-1996 average: 124 birds/year; Table 5) and, unlike Guyana, currently allows export of Hawk-headed Parrots. Some birds may still be trapped in Guyana and smuggled to Surinam (see illegal trade section above).

There were too few observations to perform the analysis to estimate densities.

Table 47. Hawk-headed Parrot survey results. Count periods are 15 minutes. S=September count (all others March-May); *count not used in estimates for density (rain, etc.); **count at repeated point; in density estimates results combined; *** using results from either East Coast April (apr) or East Coast Sept. (spt).

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ count period
EAST COAST APRIL				
1	AM	12	0	0.00
2	AM	12	0	0.00
3	AM	12	0	0.00
30	AM	10	0	0.00
24	AM	10	0	0.00
26	AM	8	0	0.00
27	AM	6	0	0.00
28	AM	2	0	0.00
29	AM	3	0	0.00
total		75	0	0.00
REGION 1				
4	PM	1	0	0.00
5	AM	3	0	0.00
6	AM	5	0	0.00
7	AM	3	0	0.00
8	AM	6	0	0.00
9	PM	1	0	0.00
10	AM	3	0	0.00
11	AM	7	0	0.00
12	PM	5	0	0.00
13	AM	4	0	0.00
14	PM	6	0	0.00
15	AM	6	0	0.00
16	AM	5	0	0.00
17	AM	4	0	0.00
18	PM	7	0	0.00
19	AM	9	0	0.00
20	AM	3	0	0.00
21	AM	5	0	0.00
22	PM	8	0	0.00
23	AM	9	0	0.00
total		100	0	0.00
KAMARANG				
31	PM	5	0	0.00
32	AM	11	0	0.00
33	AM	10	0	0.00
34	AM	9	0	0.00
35	PM	6	0	0.00
36	AM	10	3	0.30
37	PM	6	1	0.17
38	AM	10	0	0.00
39	PM	6	0	0.00
40	AM	8	0	0.00
*41	PM	5	0	0.00
42	AM	6	0	0.00
44	AM	13	0	0.00
45	AM	10	0	0.00
46	AM	11	0	0.00
total		126	4	0.03

STRATUM count #	AM or PM	# count periods	# Parrots	Parrots/ Count period
EAST COAST SEPT.				
S1	PM	4	0	0.00
S2	AM	6	0	0.00
S3	PM	4	0	0.00
S4	AM	8	0	0.00
S5	AM	6	0	0.00
S10	AM	8	0	0.00
S11	PM	6	0	0.00
total		42	0	0.00
RUPUNUNI SAV.				
47	PM	4	0	0.00
48	AM	7	0	0.00
49	AM	3	0	0.00
50	AM	6	0	0.00
51	PM	6	0	0.00
52	AM	9	0	0.00
53	PM	6	0	0.00
54	AM	3	0	0.00
55	AM	2	0	0.00
56	AM	4	0	0.00
total		50	0	0.00
TERRA FIRME-N				
57	AM	10	9	0.90
58	PM	8	4	0.50
59	AM	10	0	0.00
*60	PM	2	0	0.00
61	PM	4	0	0.00
S6	AM	8	0	0.00
S7	AM	4	0	0.00
S8	AM	4	0	0.00
S9	PM	6	4	0.67
S12	AM	8	0	0.00
*25	PM	11	0	0.00
total		75	17	0.23
TERRA FIRME-S				
62	AM	7	0	0.00
**62	AM	9	0	0.00
63	AM	10	0	0.00
64	PM	5	0	0.00
**64	AM	5	0	0.00
65	PM	4	5	1.25
total		40	5	0.13
overall total***	apr	466	26	0.06

DISCUSSION

The history of the wildlife trade in Guyana has been sparked by concerns that the trapping was not being done at sustainable levels. Many tropical countries, including most of those in South America, have responded to such concerns by completely shutting down the exportation of parrots and other wildlife, as many biologists have advocated (e.g., Beissinger and Bucher 1992a). In Guyana, a complete shutdown of the trade could have negative consequences for both people and wildlife. First, the parrot trade provides income to approximately 600 people in Guyana (see above); most of these are farmers in hinterland regions that do not have access to other cash markets. The trade brings taxes to Guyana's government that theoretically could help in promoting conservation of wildlife. By shutting off the wildlife trade, the people of Guyana would lose some of the economic value that functioning ecosystems provide; this loss would increase incentives to open up these ecosystems to other, more destructive economic uses (agriculture, timber harvesting, mining). Second, shutdowns of the wildlife trade may facilitate the development of illegal markets. For instance, the moratorium on the trade from 1993 - 1995 may have helped to open up the smuggling market to Surinam (see p. 40). Legitimate markets are much preferred to illicit ones; the extent of trade by legitimate markets can be measured and regulated, unlike illicit markets. In this context, this author recommends that Guyana continue its wildlife trade, but only if the species can be harvested sustainably (see below).

SUSTAINABILITY

One primary objective of this study is to determine the level at which parrots may be sustainably harvested from the wild for the export wildlife trade. Sustainable use is defined by the Wild Bird Conservation Act of the United States as: "the use of a species in a manner and at a level such that populations of the species are maintained at optimal levels for the long term and involves a determination of the productive capacity of the species and its ecosystem, in order to ensure that utilization does not exceed these capacities or the ability of the population to reproduce and maintain itself." (United States Fish and Wildlife Service 1996, p. 2085). The basic premise of sustainable harvesting is that healthy wildlife populations tend to produce more young each generation (assumed to be one year for parrots) than is necessary to replenish the population. For populations of stable size, the "excess" individuals produced each year will either emigrate or die from various sources (predation, starvation, etc.); the emigration or mortality does not necessarily have to be those individuals born in that year (see below). In general, if annual harvesting levels do not surpass this reproduction "excess," then the populations will remain stable and the harvesting could be determined to be sustainable.

This oversimplification overlooks some important considerations. For example, populations may not be stable if the age structure of the population changes. If the mortality of a population is concentrated in the juvenile age classes, as it often is, but breeding individuals are being harvested, then the number of individuals in the population's breeding age classes would decline. With declines in the number of breeding individuals, reproduction would decrease and the population would decline. Another important consideration is inter-annual

variation, especially variation that may result from potentially catastrophic events that occur infrequently. "Sustainable" levels of harvesting of a population are likely to be determined during normal years; however that level of harvesting may seriously endanger a population undergoing a "100-year event", like a serious El Niño (or ENSO) climatic episode. During and following such events, no reproduction may occur, and all individuals harvested would be from the breeding age classes. It may be difficult for parrot populations to recover from such an event, even without harvesting.

To correctly determine levels of sustainable harvesting, a number of population parameters need to be known. These parameters include such life history characteristics as: age specific reproductive rates, age-specific mortality rates, levels of emigration and immigration, age of first breeding, clutch size, and population size. Unfortunately these parameters are difficult to obtain for even simple wildlife populations; for long-lived and far-ranging species like parrots, such important data is almost completely lacking. As a result, most studies that have estimated levels of sustainable harvesting have done so with rather crude data.

The necessary population parameters for parrots in the Neotropics are almost entirely lacking. For what little data is available, it appears that larger species have relatively lower reproductive output than smaller species. For large macaws, only one-third of breeding age individuals may breed in any one year (Munn 1992). Although clutch sizes may be 2-3 eggs, usually only one is fledged per nest (Munn 1994, E. Nycander, pers. comm.). From the data available (see species accounts; Forshaw 1977) Amazona parrots probably fledge two young per nest on average. Smaller parrots may have larger clutches and breed annually (Waltman and Beissinger 1992). Pet parrots are well-known for their longevity; in the wild, however, the mortality rates of Neotropical parrots are not known.

Because these data are lacking for parrot species in the wild, the usual course of action has been to conservatively estimate population size and then allow an annual harvest of a small percentage of that population size (Lambert 1992, Wiedenfield 1993, 1995, Moyer 1994).

Placing quotas on the numbers of birds that may be harvested would be a more reasonable course. However, the enforcement of such quotas would be difficult because trappers are distributed throughout the country and there is no already-set means of controlling internal trade. At the export level, however, there is a set regulatory infrastructure for collecting taxes and enforcing quotas. However, enforcing harvest quotas at the export level is neglecting several additional sources of loss from populations. Foremost among these sources are smuggling, internal markets, and mortality between trapping and exporting. The smuggling of parrots trapped in Guyana to Surinam may equal the number legally exported from Guyana (see Illegal markets above). Trapping for internal markets and mortality may each account for each another 10-15 percent of all parrots trapped in Guyana (see Internal Markets and Mortality above). Adding these factors together, for every parrot exported from Guyana, 2.6 birds are trapped (Figure 12).

COMPUTATION OF QUOTAS

At every level of population estimation and computation of harvest levels it is best to take a conservative approach to estimating sustainable harvest levels (Thomsen and Brautigam 1991). Because of the potentially large positive biases in population estimates (see p.33) and because enforcing export quotas does not account for all parrots being harvested (Figure 12), I have used a very conservative figure - the lower 95% confidence interval of estimated population size - from which the export quotas will be computed. The lower 95% confidence interval of estimated population size has been used by other researchers for calculating quota levels for harvesting wild populations of parrots (Lambert 1992, Wiedenfield 1993, 1995, Moyer 1994). These studies then set annual quota levels at 5% of this lower population estimate. For three reasons, I will here use a more conservative figure of 1% of the lower population estimate for recommending quotas. First, I feel that for most species the results of the estimations of population densities (tables in species accounts) are much larger than actual population densities (see p. 33). Second, because the larger species, especially the large macaws, have very slow reproductive rates, a smaller percentage of the population should be harvested annually than for smaller species. Other studies that have recommended quotas from parrot populations whose sizes were estimated in a manner similar to this study (Lambert 1992, Wiedenfield 1993, 1995, Moyer 1994), did not compute quotas for macaws. Third, approximately 2.6 parrots are trapped in Guyana for each bird legally exported because of smuggling, mortality, and selling for internal markets (Figure 12). Nevertheless, even at one percent, many quotas would be substantially higher than the current quotas (Table 48). Because it was not possible to assess if parrot populations are currently declining (or growing) in Guyana, the affects of the current levels of harvesting on parrot populations could not be assessed. Therefore, I am very hesitant to recommend large increases in quotas until better data are in. As a result, I recommend that quotas be raised no more than 10 percent above current quotas for species with current non-zero levels of harvest. Of course, the recommended quotas can be no more than one percent of the lower estimated population size. For those species with current zero quotas for which I was able to estimate population size (Dusky Parrot and Blue-cheeked Parrot), I will recommend quotas based on my estimated population sizes (using the lower population estimate), assessments of how reliable my population estimates are, and possible affects of the illegal trade with Surinam (see p. 40). These quotas will not be more than 25% of the maximum allowable quota based on the survey results (one percent of lower population estimate; see below).

Table 48. Export quotas for wild caught birds in Guyana. The gain in US$ is calculated by multiplying the rise in the quota, if any, by the declared value for the species (Table 4a).
* Estimated population sizes not available (see text);
** one percent lower population estimate less than current quota (see text);
***see text for computation of quota.

species	1% lower estimated population	current quotas	10% current quotas	recommended quota	US$ gain in export market
Blue-and-Yellow Macaw	1554	720	72	792	18144
Scarlet Macaw	*	zero	0	zero	0
Red-and-green Macaw	3205	900	90	990	25920
Chestnut-fronted Macaw	*	zero	0	zero	0
Red-bellied Macaw	11474	1500	150	1650	9750
Red-shouldered Macaw	9767	1000	100	1100	5000
White-eyed Parakeet	1775	300	30	330	2160
Sun Parakeet	*	zero	0	zero	0
Brown-throated Parakeet	18291	500	50	550	700
Fiery-shouldered Parakeet	1965	120	12	132	432
Painted Parakeet	*	300	0	300	0
Golden-winged Parakeet	31767	180	18	198	396
Green-rumped Parrotlet	*	600	0	600	0
Dusky-billed Parrotlet	*	zero	0	zero	0
Tepui Parrotlet	*	zero	0	zero	0
Lilac-tailed Parrotlet	*	zero	0	zero	0
Sapphire-rumped Parrotlet	*	zero	0	zero	0
Scarlet-shouldered Parrotlet	*	zero	0	zero	0
Black-headed Parrot	582	600	**	600	0
Caica Parrot	*	zero	0	zero	0
Blue-headed Parrot	19809	900	90	990	3240
Dusky Parrot	3519	zero	0	500***	43000
Blue-cheeked Parrot	6231	zero	0	200***	43200
Festive Parrot	*	zero	0	zero	0
Yellow-headed Parrot	892	1000	**	1000	0
Orange-winged Parrot	61649	9000	900	9900	28800
Mealy Parrot	4586	1000	100	1100	7200
Hawk-headed Parrot	*			zero	0
				total US$ added	187942

QUOTAS

In Table 48, recommended quotas are given for the all species of parrots known from Guyana. In summary, it is recommended: that 12 species continue with their current quotas of zero; that two species currently with zero quotas (Dusky Parrot and Blue-cheeked Parrot) be given small quotas; that quotas for four species (Painted Parakeet, Green-rumped Parrotlet, Black-headed Parrot, and Yellow-crowned Parrot) remain the same as current quotas; and that quotas for the other 13 species are raised (but no more than 10 percent higher) above current quotas. For all 13 species that have higher quotas recommended, the new quotas are not more than 51 percent of the allowable quota based on the survey results (one percent of lower population estimate). In the following accounts, I give a short synopsis of the quotas for each of the species that has been recorded in Guyana.

Blue-and-Yellow Macaw

The recommended quota for this species is 792 birds/year, ten percent higher than the current quota of 700 birds/year. Numbers of this species should be carefully monitored. The recommended quota is 51 percent of the allowable quota based on the survey results (one percent of lower population estimate).

Scarlet Macaw

It is recommended that the quota for this CITES Appendix I species stay at its current quota of zero. Although its habitat (Terra Firme forests) is widely distributed, this is the least common of the three large macaws in Guyana.

Red-and-Green Macaw

It is recommended that the current quota of 900 be raised to 990 birds/year. This species occurs widely in Guyana, and is the most common of three large macaws. It is most common in terra firme forests, the most extensive habitat type in Guyana. However, it is probably not very tolerant of habitat disturbance, and numbers should be closely monitored. The recommended quota is only 31 percent of the allowable quota based on the survey results (one percent of lower population estimate).

Chestnut-fronted Macaw

The present status of this species in Guyana is uncertain, and it is recommended that this species not be exported from Guyana.

Red-bellied Macaw

It is recommended that the current quota of 1500 be raised to 1650 birds/year. This species is quite common in a variety of habitats in Guyana, and it seems to be tolerant of some degree of

Sapphire-rumped Parrotlet

Although this species may be common in parts of Guyana, its present status is uncertain. There does not appear to be any demand in the export wildlife trade for this species. It is recommended that this species not be exported from Guyana.

Scarlet-shouldered Parrotlet

This species appears to be quite rare in Guyana. It was not seen during this study; it is recommended that this species not be exported from Guyana.

Black-headed Parrot

From the survey results it appears that this species is widespread but uncommon in Guyana, although it occurs in the most extensive habitat type- terra firme forests. However, the survey methodology was inappropriate for estimating densities for this species, and other sources stated that this species can be quite common (see species account). Nevertheless, the calculation of the quota (one percent of the lower estimated population size) resulted in a number nearly equal to the current quota; therefore it is recommended that the current quota of 600 birds/year be maintained. Subsequent surveys (especially those that employ a different methodology) may show that the populations of this species are larger and could sustain a higher level of harvesting.

Caica Parrot

Although widespread, this species appears to be quite uncommon in Guyana; it is recommended that the current zero quota for this species be maintained.

Blue-headed Parrot

This species is common throughout most of Guyana, and, at least seasonally, it appears to be able to use somewhat disturbed habitats. It is recommended that the current quota of 900 be raised to 990 birds/year. Guyana populations of this species could probably sustain an even greater amount of harvesting; the recommended quota is only five percent of the allowable quota based on the survey results (one percent of lower population estimate).

Dusky Parrot

Although this species currently has a zero quota in Guyana, large numbers may be smuggled to Surinam (see illegal markets above). Nevertheless, this species appears to be widespread in small numbers Guyana. Its preferred habitat - terra firme forest - is the most widespread habitat in the country. The population estimates resulting from the surveys indicate that this species could sustainably endure a small amount of harvesting. Opening up a legal market in Guyana and reducing smuggling to Surinam (see Recommendations below) would make the trade of species easier to monitor, and Guyana would then enjoy much greater economic benefits. An annual quota of 500 birds is recommended. This quota is only 14.2 percent of

the maximum allowable quota based on the survey results (one percent of lower population estimate).

Blue-cheeked Parrot

Although this species has been listed as threatened (e.g., Collar et al. 1994), this listing has been based on a lack of sufficient information and not on known population declines (see species account). During this study it was found to be a common parrot in the Kamarang stratum during the presumed breeding season. After breeding, this species presumably disperses to the coastal plain (see species account).
This species currently has a zero quota in Guyana. Small numbers may be smuggled to Surinam (see illegal markets above). The population estimates resulting from the surveys indicate that this species could sustainably endure a small amount of harvesting. Opening up a legal market in Guyana and reducing smuggling to Surinam (see Recommendations below) would make the trade of species easier to monitor, and Guyana would then enjoy much greater economic benefits. An annual quota of 200 birds is recommended. This quota is only 3.2 percent of the maximum allowable quota based on the survey results (one percent of lower population estimate) because there may be some positive bias in the survey methodology (see p. 33).

Festive Parrot

The present status of this species in Guyana is uncertain; small numbers may occur seasonally in flooded forests in Region I. Many of these birds may breed in Venezuela, where its preferred habitat of flooded forests is widespread, and visit Guyana only seasonally. It was not recorded during the surveys. Because the species' status is uncertain, and the subspecies in Guyana has a small distribution, it is recommended that this species not be exported from Guyana.

Yellow-crowned Parrot

From the survey results it appears that this species is widespread in rather open habitats in Guyana, but its numbers are surpassed almost everywhere by Orange-winged Parrots. Good numbers were found on a few counts. The calculation of the quota (one percent of the lower estimated population size) resulted in a number nearly equal to the current quota (Table 48); therefore it is recommended that the current quota of 1000 birds/year be maintained.

Orange-winged Parrot

Although this species has always been the most heavily exported species in Guyana (Table 2), it still is the most common and widespread parrot species in the country. It occurs in nearly every habitat and appears to be tolerant of a good deal of disturbance; it even occurs widely in downtown Georgetown (pers. obs.). It is recommended that the current quota of 9000 birds/year be raised to 9900 birds/year. Even this increased quota is only 16.1 percent of the maximum allowable quota based on the survey results (one percent of lower population estimate).

REGULATORY STRUCTURE

An important part of any program that seeks to sustainably harvest wildlife populations is a functioning regulatory structure. The regulatory structure of the legal wildlife trade in Guyana, regulated by the Wildlife Services Division of the Ministry of Agriculture (see p. 34), is similar to those in Nicaragua and Surinam; the regulatory structures of these two countries have been termed "model" (Surinam: Thomsen and Brautigam 1991, p. 378) or "perfectly adequate" (Nicaragua: Wiedenfield 1995, p. 49).

The regulatory structure of export wildlife trade should ensure that the foreign capital generated by the trade remains in the country and is distributed fairly (Thomsen and Brautigam 1991). In Nicaragua, a minimum price is set for each species (similar to the export value for parrots in Guyana), and all birds must be sold at least that price; the income generated (the minimum price) is directly deposited into local banks. The minimum price and deposition of money in local banks in Nicaragua is to ensure that the fair market value reaches the country and that this money is not expatriated. Although Guyana does not follow these practices, expatriation of income was never mentioned as a problem in any of my interviews with members of the exporter community. Because only Guyanese may be licensed to export, income from the birds they sell goes into Guyana's internal economy. None of the exporters mentioned that the value per parrot declared by the government was too high; it therefore appears that the exporters in Guyana are receiving a fair market value. Within Guyana, the disbursement of the gross income obeys internal economies; as a result, no set amount is distributed to middlemen or trappers. It has been proposed to distribute a percentage (5%) of the 20% tax levied by the Ministry of Agriculture to indigenous communities; most of the parrots trapped in Guyana are trapped by indigenous people on land regulated by their communities. Most exporters interviewed supported offering a percentage to indigenous communities.

Although the Wildlife Services Division has a properly structured regulatory system, the relationship between the exporter community (and, to a lesser extent the middlemen and trappers) and the Wildlife Service is generally poor. According to the exporters, much of their discontent the past two years derives from delays in the opening of the season for exporting. As a results of delays, exporters hold parrots for longer periods in their quarantine stations, and incur additional costs to house and feed the birds, as well as losing a small percentage of birds to mortality. In addition, Guyanese exporters lose some competitiveness on the international market, especially through competition with exporters from Surinam, who are largely shipping the same parrot species. This competition may increase the illegal selling and smuggling of birds to Surinam (see pp. 41). Every effort should be made by the Wildlife Services Division to open the export season in a timely manner.

FUTURE MONITORING

The continued existence of the export wildlife trade in parrots is dependent on a careful monitoring of population trends in parrots. Parrot populations may decline for many reasons, but chief among the threats in Guyana's future are habitat destruction and the wildlife trade. If parrots decline as result of widespread habitat destruction, an almost inevitable threat, then the harvest rates must be adjusted accordingly to prevent over-harvesting. Unfortunately, Guyana has little of the infrastructure required for a continuous monitoring program. However, funds are available through the 20 percent tax levied on exported wildlife (the Wildlife Fund) to support such a program. Taxes from the additional of US$ 188,000 of income that potentially could result from the increase in quotas recommended in this study should be earmarked for the monitoring program. This tax is potentially US$ 37,600 per year, which should be more than enough to conduct a biannual survey (see below).

Because the object of these additional surveys would be to assess trends in parrot populations, the surveys and analyses do not need to be as intensive as the baseline study presented herein. As in this study, the monitoring program should use the variable count circle methodology (see Methods above) and counts should be made over 15-minute periods. To increase sample sizes, no more than 15 minutes should be spent at any one point (unlike the present study). Trends could be detected by comparing the rates of parrots observation per 15 minute periods between years. There is no need to re-estimate population density and sizes. Quotas and conservation plans could then be adjusted for percentage changes in populations that are detected during the monitoring program. The field methodology is much simpler when just the rates are calculated, because associated distances are not needed for each observation. In addition, the analysis software used in this study (DISTANCE) is not needed because densities are not being estimated. Nevertheless, it is imperative that the observer be knowledgeable about parrot identification and be able to estimate flock sizes accurately.

The counts should be stratified and analyzed by habitat and region, similar to the strata in this study. Sample sizes should be maximized in each area and habitat. Only areas where trapping is occurring need to be monitored on a regular basis. The interior areas without trapping (e.g., the entire Terra Firme South stratum) could be surveyed less regularly (e.g., once per every six years) . Although this study can provide some baseline rates of parrot observation (from tables in the species accounts, pp. 51 to 103), the season of monitoring should be shifted in the coastal areas of Guyana (Region I and East Coast strata in this study) to the May to August period that coincides with the seasonal use of this area by parrots. Counts during the February through April breeding period should be avoided throughout the country.

The monitoring surveys should be conducted biannually. Slight declines, though significant, may take several years to detect with this sort of monitoring program. It will probably take two months to conduct all the counts necessary for each biannual survey. The cost of such a program should be easily covered through the funding sources mentioned above. Outside support may be necessary to initially set up the monitoring program, but once a field biologist is trained, the costs would not be very substantial (mostly transportation and wages for the

biologist). Students at the Centre for the Study of Biological Diversity at the University of Guyana in Georgetown are acquiring the skills for participating in this sort of survey program.

POTENTIAL FOR CAPTIVE BREEDING

Until recently the CITES agreement treated captive-bred birds as if they were wild caught; any captive-bred birds were thus considered part of the export quota from Guyana. Guyana, as a member of CITES, had to follow suit and treat captive-bred individuals as part of the export quota. CITES' treatment appears to be changing (Wiedenfield 1995), but Guyana has yet to follow suit. At least four exporters in Guyana stated that they were interested in captive breeding, but would not make the large investments necessary until captive-bred birds were treated separately from wild caught individuals in export quotas.

The process of captive breeding for the wildlife trade is a rather simple idea. An original stock of birds is obtained, usually from wild populations, but captive bred parrots can also be used. The breeding stock is used to produce young, which can be sold on the export market after they reach an independent age.

The captive breeding of parrots have several conservation and economic advantages over capturing wild -caught individuals, including

1) Fewer birds need to be harvested from wild populations. A breeding pair of captive parrots can produce several young each year for a number of years. Additional breeding stock from wild populations is occasionally necessary to replace birds lost from mortality and to maintain a genetically diverse captive stock. Nevertheless, to produce the same amount of individuals available for export, far fewer parrots need to be harvested from wild populations than if wild caught birds are being exported. This advantage accumulates over time. In the first few years, few young may be produced because the captive stock may not yet be of breeding age.

2) Captive-bred parrots have higher market value, because they are tamer and make better pets than wild caught individuals. Therefore, to achieve the same amount of income from export, fewer parrots need to be exported, or, if the same number of parrots is exported, then more money reaches Guyana.

3) A captive breeding station creates several relatively high-paying jobs. Captive breeding is labor intensive, and several people, including veterinarians, would be needed at each station for maintaining the stations and feeding and caring for the birds.

However, the captive breeding of parrots for the export market has several disadvantages over the exportation of wild-caught individuals, including:

1) Income would be even more concentrated at the exporter level. Because fewer parrots would be needed from wild-caught populations, the trappers and middlemen would lose income. Although some of this loss of income would be offset by the increased need for labor at captive breeding stations, much fewer of the latter jobs would be created . In

addition, of all people who benefit financially from the wildlife trade, the trappers have the most to lose: they are generally poor farmers with few accessible sources of cash.

2) As a result of loss of income at the trapper level, there would be less incentive for those people to conserve natural ecosystems. Indian villages and other communities may look to replace this loss of income with other sources of income that may be far more destructive to ecosystems.

3) Captive breeding is difficult and costly. In general, a great deal of capital is needed to establish a station. The amount of space and capital needed is much greater than for quarantine stations because cages need to be bigger, the birds are kept for much longer duration, and the production of young involves very intensive monitoring and costly materials (incubators, etc.). Many of these costs would be incurred at the time the station was set up, and initial costs would be far higher than the initial earnings received from captive breeding. The breeding of several species in captivity has only met with partial success, particularly many *Amazona* parrots (L. van Sertima, pers. comm.). As these costs would be incurred by the exporters, market economics would determine if captive breeding is a financially sound practice.

4) Captive breeding would require an increased regulatory infrastructure (personnel, transportation, etc.) to inspect breeding stations and to make certain that individual parrots being exported as captive-bred were in fact bred in captivity. In addition, there is currently no infrastructure to regulate the number of wild-caught individuals that could be captured for captive breeding stations. The funds needed to increase infrastructure could be offset if captive bred parrots were given a higher declared value than wild-caught individuals; the market values of captive bred parrots is generally higher (see above). The additional value would lead to additional taxation.

5) The captive breeding of some species may increase market demand for that species beyond the point which captive-reared individuals can satisfy the demand. This may increase the harvest of wild-caught individuals (Wiedenfield 1995).

To a certain extent, the advantages of captive breeding outweigh the disadvantages. In the case of the Sun Parakeet, which has almost been extirpated in Guyana (see species account), the young produced by a captive breeding program could help reestablish wild populations of the species in Guyana (e.g., see Wiley et al. 1992), as well as provide young birds for export. A ranching program (see below) could help increase productivity of the reintroduced populations. Because a wild population of this species would be much sought-after by visiting bird watchers (R. Ridgely, pers. comm., see also Munn 1992), this project may work out best as a cooperative effort between operators of tourist ranches in the Rupununi and the exporters. However, breeding stock for the captive program would have to be imported, because local populations are too small.

Some of the disadvantages of captive breeding would be offset if some continued harvest of wild-caught individuals for export was allowed to continue along with export of captive-bred individuals. Captive bred individuals should have a separate quota from wild-caught

individuals. Because one major objective of captive breeding is to reduce pressures on wild population, the capture of individuals for captive breeding programs should come out of an exporter's quota. Establishing this reduction of quota can be done directly (establishing a quota for harvesting, which would require additional regulatory infrastructure), or indirectly, at the time that the captive-bred individuals are exported. The latter would require an analysis that investigates the relative lifetime output of captive breeding versus breeding in the wild.

POTENTIAL FOR RANCHING

The reproductive output of wild populations may be increased by providing more of whatever resource is limiting the population. The limiting resource in most parrots is thought to be available nest sites, and ranching for parrots has nearly always been investigated through increasing nest sites by providing artificial nest sites (e.g., Beissinger and Bucher 1992a, 1992b, Munn 1994). The increase in reproductive output that ranching provides could then be used for export without resulting in declines to wild populations.

Beissinger and Bucher (1992a, 1992b) established a model for parrot ranching based on adding nest sites to a population of Green-rumped Parrotlets on a private ranch in Venezuela. The model has many requirements that limit the applicability to many parrot populations (Beissinger and Bucher 1992a, 1992b); drawbacks of the model are further discussed by Wiedenfield (1995). Few, if any, parrots populations in Guyana meet the requirements of this ranching model. In addition to the need for generally unavailable life history data (e.g., age specific fecundity and mortality), part of the problem in Guyana stems from the need to have large tracts of land in private ownership.

One possible exception may be macaws (and other parrots?) on indigenous lands in Guyana. In Peru, Blue-and-Yellow and Scarlet macaws have nested in large PVC pipe nest boxes placed in appropriate habitat (Munn 1994, E. Nycander pers. comm.). This project is based at a tourist lodge surrounded by mature forests (Munn 1994, Kratter 1997). The macaws (mostly Scarlet Macaws) have successfully fledged many young from these artificial nests. In addition, in many nests the second nestling, which almost always dies in natural nests, has been removed and successfully reared in captivity at the site; after reaching fledgling age, these individuals are allowed to fly freely in the surrounding forests. These semi-tame macaws are quite popular with tourists (see Munn 1992, 1994). In Guyana, a similar combined ranching and captive breeding program could produce additional young that could be sold to exporters, as well as be a tourist attraction. Although the possibility of using such a program for export has been considered, ranching programs that produce parrots for export have yet to be run as income producing operations. Unfortunately, ranching programs are very capital and labor intensive, especially for larger macaws and parrots, and such operations may not be financially viable.

Another possible case for ranching is the Sun Parakeet on tourist ranches in the Rupununi Savannas. This ranching project would have to be conducted as part of captive breeding and

reintroduction program (see above section), because populations are currently too small and endangered to profitably ranch.

If exporters or any other organization profess an interest in ranching, a preliminary analysis should be given to the Wildlife Advisory Committee, who then can assess if ranching is a feasible alternative and worthy of further consideration.

UNITED STATES WILD BIRD CONSERVATION ACT OF 1992

The United States passed the Wild Bird Conservation Act (hereafter referred to as the WBCA) on 23 October, 1992 (United States Congress 1992). This Act has had dramatic effects on the importation of birds, whether captive-bred or wild-caught, into the United States. For example, Guyana has not been able to export birds to the United States since passage of the Act.

On passage, the WBCA immediately prohibited the importation of all CITES-listed birds into the United States; later provisions amended to the WBCA have allowed importation of CITES Appendix II and Appendix III species after a number of strict requirements are met by the country exporting birds. These criteria have been spelled out in a number of documents published by the United States Fish and Wildlife Service. The importation of wild-caught birds is summarized in a final ruling by the United States Fish and Wildlife Service (1996). Wiedenfield (1995) gives an in depth analysis of how the WBCA may affect the export parrot trade in Nicaragua. Much of his discussion also has relevance to the situation in Guyana, so I will only provide the major points here.

In summary, the final ruling of the WBCA (United States Fish and Wildlife Service 1996) allows importation of wild-caught birds into the United States when the Fish and Wildlife Service determines that such importation is 1) biologically sustainable, 2) non-detrimental to species survival in the wild, and 3) that CITES is being implemented effectively in the countries from which the birds are being exported. Exporting countries have to apply to have each species imported into the U. S. .The application must show that a scientifically-based management plan has been developed for the species, and the plan has to ensure that the use of the species is biologically sustainable. The Act also requires that the methods of capture, transport, and maintenance of the species minimize the risk of injury or damage to the health, including inhumane treatment.

Specifically, the sustainable harvest management plan should show the pertinent biological data that determine the sustainability of harvest levels, including information on: 1) the status, distribution, habitats, and population trends of the species (most of which is provided in this report; population trends can be assessed if the recommended monitoring program is implemented), 2) estimates of reproductive success and mortality in the wild (which is lacking for most Guyana species), 3) estimates of present and recent use of the species for the export market, internal markets, illegal trade, and subsistence hunting (most of which is provided in this report); 4) determination of sustainable use and documentation of how sustainable use

was determined (primary objective of this report); 5) a program to monitor the population (in recommendations); 6) a description of how the management plan promotes the value of the species and its habitats (contained in the education recommendation) (United States Fish and Wildlife Service 1996). The management plan must implemented and enforced.

Satisfaction of the recommendations for quotas, for future monitoring, and to stem illegal trade, may allow Guyana to meet most of the requirements described above. The species that were recorded widely observed during the surveys stand the best chance for having the applications granted (e.g., Orange-winged Parrot; Blue-headed Parrot, Red-bellied Macaw, Red-shouldered Macaw, maybe other species). Although some of the required data for these species is weak or lacking for populations in Guyana, the U. S. Fish and Wildlife Service expects to give positive consideration to countries that set conservative export quotas, while working to obtain the remainder of the necessary data (United States Fish and Wildlife Service 1994).

Separate applications are made for wild-caught and captive bred individuals. The WBCA also has strict guidelines for the importation of captive bred individuals into the United States (see Wiedenfield 1995). Application must be made for the facility as well as each species.

RECOMMENDATIONS

The following are recommendations for improving the control, management, and conservation of parrots in Guyana. The recommendations are derived from information given in this report. The satisfaction of some or all of these recommendations may help Guyana meet the requirements of the Wild Bird Conservation Act of 1992 (WBCA) for importing birds to the United States. Guyana would thereby be able to re-establish the export of parrots to the United States.

1. Adopt the export quotas for wild-caught birds in Table 48. Although subdividing quotas so that the individual regions each have their own quota would be preferable (see pp. 124), Guyana does not have the infrastructure to enforce quotas at this level. Nevertheless, it is recommended that when applying for permits to export, the exporters state the providence of each bird they intend to export. Although this may be difficult because exporters often buy from middlemen, at the transaction of the birds the middlemen should be asked where the parrots were trapped. The harvesting levels in the various subdivisions should be periodically analyzed to ensure that particular populations are not being over-harvested (see maximum harvest levels in Table 49). The current trapping and export seasons should be maintained.

2. Establish a program to continually monitor wild populations of parrots in Guyana. This report can provide the foundation for the monitoring program, but the monitoring program does not need to be as involved as the present study. For the coastal areas of Guyana (the Region I and East Coast strata in this study), monitoring should be conducted in the May to August period that coincides with the seasonal use of this area by parrots. Counts during the February through April breeding period should be avoided throughout the country. The monitoring program should use the variable count circle methodology (see Methods above) and count should be made over 15-minute periods. Analyses should stress changes in the rate of parrot observations between years, not population estimates. The counts should be stratified and analyzed by habitat and region, similar to the strata in this study. However, only areas where trapping is occurring need to be monitored on a regular basis. Surveys should occur no less frequently than every two years. Funds for this program should come from the Wildlife Fund (see Recommendation 3).

3. It is recommended that the Ministry of Agriculture, with the assistance of the Wildlife Advisory Committee, draw up new legislation (or petition the Legislature to do so)that determines the disbursement of money in the Wildlife Fund. Because parrots potentially provide 67% of the taxes that feed this fund, a like percentage should be used to support their conservation. Taxes from the additional income generated by the raised quotas recommended in this report (potentially US$ 37,600/year: Table 48) should go to the program to monitor parrot populations (Recommendation 2). Other money from the Wildlife Fund should go to supplies for the Wildlife Services Division, including transportation for inspecting parrots and quarantine stations, and to programs that help educate trappers (see Recommendation 8). It is recommended that the proposal for giving

a percentage of the levies collected back to indigenous communities (see p. 126) through the Bureau of Amerindian Affairs be adopted.

4. For the wildlife trade to continue in the long term, it is imperative that Guyana set up some sort of system of protected areas. Protected areas would ensure that Guyana has healthy wildlife populations that can serve as the source populations to produce the excess of individuals that is necessary for sustainable harvesting to continue. Protected areas would also give some sort of insurance against large-scale habitat destruction. The WBCA requires that Guyana have some a program for habitat management, in addition to a parrot management program. Unfortunately, it will probably take many years to establish a system of protected areas, although parks are in the planning stages in the Kanuku Mountains of the central Rupununi, and an enlargement of Kaeiteur National Park is also planned (N. Waldron, pers. comm.). To ensure the continued existence of a wildlife trade, the Wildlife Services Division, the Wildlife Advisory Committee, and the exporter community should encourage the government of Guyana to establish a system of protected areas; the trapping of parrots and other wildlife should not be allowed within these areas. Conservationists usually recommended that ten percent of a country's area be given some sort of protected area status. It is recommended that Guyana give at least five percent of its total area protected area status by 2008 (10 years from now); the trapping of parrots and other wildlife should not be allowed within these areas. In the meantime, the Wildlife Services Division with input from the Wildlife Advisory Committee, should declare areas closed to parrot trapping; the amount of closed areas should total ten percent of Guyana's area. This could be easily done because trapping efforts are concentrated in a few areas (coastal plain and Rupununi areas), and most of Guyana has no trapping at all.

5. Because smuggling birds to Surinam is a large-scale problem in Guyana, serious efforts should be made to stem this flow. First, if it is not illegal already, the purchase of wildlife by non-nationals should be made illegal. Second, it is recommended that Guyana and Surinam coordinate their open and exporting seasons, so that each country would be equally competitive in the international market place. Surinam should also be asked (by Guyana and CITES) to have an levy equal to Guyana's (20% of declared value) placed on birds exported from that country. Much of the illegal trade may stem from the economically competitive advantages enjoyed by Surinam (see pp. 41) relative to Guyana, which allow Surinamese buyers to outbid Guyanese for birds trapped in Guyana. Third, it is recommended that the Wildlife Service Division be punctual about opening up the export season, so that Guyana does not lose competitiveness in the international market place. Delays in 1996 and 1997 resulted in a drop in competitiveness and the longer holding of birds at quarantine stations, thereby increasing mortality and costs to the exporters.

6. The office of the Wildlife Services Division, working with the Wildlife Advisory Committee, should prepare applications to allow for exporting wild-caught birds to the United States under the WBCA. Using information from this report, along with information available to The Wildlife Services Division, applications could be made for birds that have recommended quotas in Table 48.

7. The Wildlife Services Division should encourage the development of captive breeding programs by the exporters. Parrots raised in captive breeding facilities should not be included in the export quotas recommended for wild-caught parrots. Wildlife Services Division should prepare itself to support applications by Guyana breeders to become qualified captive breeding facilities under the WBCA.

8. Guyana should develop a country-wide conservation education program that emphasizes parrots. Such a program could emphasize the ecological and aesthetic benefits of parrots, as well as the economical benefits brought by a sustainable wildlife trade and the conservation "pay-offs" that result from value added to intact ecosystems (see p. 12). Such a conservation education program could assist greatly in shaping public opinion, which in turn could lead to greater public acceptance of conservation ideas (Butler 1992). Such a program could be set up through the combined efforts of the exporter community, the Ministry of Education, the Ministry of Agriculture, and Conservation International - Guyana, which is currently establishing a conservation education program in Guyana (N. Waldron, pers. comm.).

The Ministry of Agriculture and the exporters should encourage the further education of trappers and middlemen in the proper maintenance and care of trapped parrots. For two parrot species (Blue-cheeked Parrot and Fiery-shouldered Parrots), the new quotas may result in opening up new or under-used areas for the trapping of parrots, especially near Kamarang and Paramakatoi (Figure 8), where both species are plentiful (see species accounts) and both areas are regularly serviced by aircraft. If exporters expect to use these areas, then the new trappers in the area would need to be trained in correct trapping methods and care of the birds. Funding for such training sessions could come from the Wildlife Fund (see Recommendation 3). The Ministry of Agriculture and exporters should encourage the education of trappers in these areas. Expanding the trade to the Kamarang and Paramakatoi areas would likely result in the decrease or elimination of the shooting of parrots for food or because they are agricultural pests.

9. It is recommended that the Wildlife Advisory Committee add a member that represents the middlemen or trapping communities.

10. It is recommended that the Ministry of Agriculture do not add to the number of current licenses (at the end of 1997) without a concomitant increase in quotas.

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APPENDIX I. Template file for DISTANCE program (version 2.2) formatted for this study. "Samples" refer to survey points (see Appendix II). Data for each observation are entered as "distance, number of birds in flock" under each sample. For example if two flocks were seen in sample 1, the first of five birds at 100 m and the second of 10 birds at 500 m, then sample 1 statement would look like:

sample/effort=5/label='sample 1';
100,5,
500,10;

See Buckland et al. (1993) for full explanation of DISTANCE software.

```
opt;
type=point;
object=cluster;
distance=radial/units='meters';
area/units='kilometers';
end;
data;
stratum/label='region ec-APR'/area=12780;
sample/effort=5/label='sample 1';
;
sample/effort=5/label='sample 2';
;
sample/effort=5/label='sample 30';
;
sample/effort=5/label='sample 24';
;
sample/effort=5/label='sample 3';
;
sample/effort=4/label='sample 26';
;
sample/effort=3/label='sample 27';
;
sample/effort=1/label='sample 28';
;
sample/effort=1/label='sample 29';
;
stratum/label='region ec-SEP'/area=12780;
sample/effort=2/label='sample s1';
;
sample/effort=3/label='sample s2';
;
sample/effort=2/label='sample s3';
;
sample/effort=4/label='sample s4';
;
sample/effort=3/label='sample s5';
;
sample/effort=2/label='sample s10';
;
sample/effort=3/label='sample s11';
;
stratum/label='region 1'/area=9390;
```

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APPENDIX II. Data on survey points. Time, weather, and sum of parrot counts

Count #	count name	stratum	date	AM or PM	Time	Rain*	# count periods	total # parrots	parrots/period
1	TIM1	ECA	28-Mar-97	AM	0545-0845	0	12	144	12.00
2	DORA	ECA	30-Mar-97	AM	0545-0845	0	12	381	31.75
3	MIC1	ECA	31-Mar-97	AM	0530-0830	0	12	243	20.25
4	MOR0	RG1	3-Apr-97	PM	1655-1710	0	1	31	31.00
5	MOR2	RG1	4-Apr-97	AM	0545-0615	0	3	450	150.00
6	MOR3	RG1	4-Apr-97	AM	0654-0810	0	5	236	47.20
7	WAI1	RG1	5-Apr-97	AM	0601-0631	1	3	7	2.33
8	WAI2	RG1	5-Apr-97	AM	0656-0826	1	6	228	38.00
9	WAI3	RG1	5-Apr-97	PM	1705-1720	0	1	8	8.00
10	WAI4	RG1	6-Apr-97	AM	0545-0630	0	3	88	29.33
11	WAI5	RG1	7-Apr-97	AM	0605-0750	0	7	351	50.14
12	WAU	RG1	7-Apr-97	PM	1700-1815	0	5	118	23.60
13	ARU1	RG1	8-Apr-97	AM	0540-0710	2	4	151	37.75
14	ARU2	RG1	8-Apr-97	PM	1640-1810	2	6	45	7.50
15	ARU3	RG1	9-Apr-97	AM	0540-0710	0	6	26	4.33
16	ANA1	RG1	10-Apr-97	AM	0530-0645	0	5	48	9.60
17	BARI1	RG1	10-Apr-97	AM	0700-0800	0	4	38	9.50
18	ANA2	RG1	10-Apr-97	PM	1620-1805	0	7	20	2.86
19	ANA3	RG1	11-Apr-97	AM	0535-0750	0	9	88	9.78
20	KAI1	RG1	12-Apr-97	AM	0520-0635	0	3	93	31.00
21	KAI2	RG1	12-Apr-97	AM	0645-0800	2	5	142	28.40
22	KAI3	RG1	12-Apr-97	PM	1600-1800	0	8	41	5.13
23	KAI4	RG1	13-Apr-97	AM	0540-0755	0	9	59	6.56
24	MNCA	ECA	17-Apr-97	AM	0640-0910	0	10	65	6.50
**25	GOAT	TFN	17-Apr-97	PM	1530-1815	*	11	61	5.55
26	BER1	ECA	19-Apr-97	AM	0635-0835	0	8	71	8.88
27	WIN	ECA	20-Apr-97	AM	0650-0820	0	6	74	12.33
28	COR1	ECA	21-Apr-97	AM	0605-0635	0	2	23	11.50
29	COR2	ECA	21-Apr-97	AM	0710-0755	0	3	36	12.00
30	GAR1	ECA	22-Apr-97	AM	0554-0824	0	10	633	63.30
31	WAR1	KAM	24-Apr-97	PM	1645-1800	3	5	10	2.00
32	WAR2	KAM	25-Apr-97	AM	0540-0825	1	11	154	14.00
33	PAR1	KAM	26-Apr-97	AM	0530-0800	0	10	59	5.90
34	KAM1	KAM	27-Apr-97	AM	0550-0815	0	9	30	3.33
35	KAM2	KAM	27-Apr-97	PM	1648-1809	0	6	26	4.33
36	MAZ1	KAM	28-Apr-97	AM	0535-0805	0	10	174	17.40
37	MAZ2	KAM	28-Apr-97	PM	1645-1810	0	6	296	49.33
38	KAKO1	KAM	29-Apr-97	AM	0515-0800	0	10	93	9.30
39	MAZ3	KAM	29-Apr-97	PM	1615-1800	2	6	69	11.50
40	MAZ4	KAM	30-Apr-97	AM	0545-0745	0	8	42	5.25
*41	KUKUI	KAM	30-Apr-97	PM	1635-1745	2	5	10	2.00
42	MAZ5	KAM	1-May-97	AM	0550-0710	2	6	12	2.00
**43	PK1	KAM	2-May-97	PM	1625-18-5	1	6	22	3.67
44	PK2	KAM	3-May-97	AM	0530-0845	1	13	66	5.08
45	PK3	KAM	4-May-97	AM	0530-0800	0	10	172	17.20
46	PK4	KAM	5-May-97	AM	0515-0815	1	11	98	8.91
47	MOCO	RUP	6-May-97	PM	1655-1805	0	4	0	0.00

Count #	count name	stratum	date	AM or PM	Time	Rain*	# count periods	total # parrots	parrots/period
48	FARM	RUP	7-May-97	AM	0535-0717	2	7	10	1.43
49	BURI1	RUP	7-May-97	AM	0735-0820	2	3	37	12.33
50	AISH1	RUP	8-May-97	AM	0710-0840	2	6	249	41.50
51	AISH2	RUP	8-May-97	PM	1630-1800	0	6	612	102.00
52	AISH3	RUP	10-May-97	AM	0740-0755	2	9	112	12.44
53	AISH4	RUP	10-May-97	PM	1645-1810	0	6	151	25.17
54	AWAR 1	RUP	11-May-97	AM	0555-0640	0	3	177	59.00
55	AWAR 2	RUP	11-May-97	AM	0700-0730	0	2	4	2.00
56	NAPPI	RUP	12-May-97	AM	0615-0715	0	4	25	6.25
57	IWOK1	TFN	13-May-97	AM	0540-0810	2	10	49	4.90
58	SURA MA	TFN	13-May-97	PM	1620-1810	0	8	161	20.13
59	WOW1	TFN	14-May-97	AM	0545-0815	0	10	524	52.40
*60	WOW2	TFN	14-May-97	PM	1615-1640	0	2	6	3.00
61	WOW3	TFN	14-May-97	PM	1700-1800	0	4	97	24.25
62	GUNN2	TFS	18-May-97	AM	0650-0835	0	7	42	6.00
***62R	GUNN2	TFS	20-May-97	AM	0555-0815	0	9	169	18.78
63	GUNN3	TFS	19-May-97	AM	0555-0825	1	10	239	23.90
64	GUNN4	TFS	19-May-97	PM	1640-1755	0	5	225	45.00
***64R	GUNN4	TFS	21-May-97	AM	0715-0830	1	5	300	60.00
65	GUNN5	TFS	20-May-97	PM	1640-1755	0	4	101	25.25
S1	MAH1	ECS	4-Sep-97	PM	1640-1740	0	4	151	37.75
S2	MAH2	ECS	5-Sep-97	AM	0630-0800	0	6	110	18.33
S3	MARA	ECS	5-Sep-97	PM	1640-17.55	0	5	216	43.20
S4	ITHAC A	ECS	6-Sep-97	AM	0545-1600	0	8	79	9.88
S5	CANJE	ECS	7-Sep-97	AM	0545-0730	0	7	136	19.43
S6	ROCK	TFN	9-Sep-97	AM	0550-0805	0	9	92	10.22
S7	BOOT	TFN	10-Sep-97	AM	0545-0645	0-fog	4	13	3.25
S8	BIBE	TFN	10-Sep-97	AM	0725-0825	0	4	20	5.00
S9	YAR	TFN	10-Sep-97	PM	1620-1750	0	6	58	9.67
S10	MANA CA	ECS	11-Sep-97	AM	0640-0755	0	5	175	35.00
S11	SAKS	ECS	11-Sep-97	PM	1600-1800	0	8	741	92.63
S12	GOAT	TFN	12-Sep-97	AM	0550-0750	*	8	71	8.88
	TOTAL		79 COUNTS AT 75 POINTS				516	10484	20.32

*0=no rain; 1= light rain during less than 75% of count periods; 2=steady light rain or moderate/heavy rain during < 50% of count periods; 3=moderate/heavy rain during > 50% of count

**count not used in estimates for density (rain, overlapping with other counts)

***count at repeated point; in density estimates results combined

APPENDIX II (cont.). Data on survey points. Latitude, longitude, locales,and habitats.

count#	Coordinates	nearby landmarks	habitat
1	6°31.09'N, 58°11.20'W	Swan, E. Timehri-Linden Hwy.	white-sand scrub/sec. forest
2	6°17.70'N, 58°15.97'W	Dora village ,Demerarra R.	agriculture/riparian forest
3	6°21.37'N, 58°46.48'W	E. Wash Clothes, Mahaicony R.	agricultural
4	7°37.86'N, 58°52.50'W	Moruka R., S. of mouth	floodeed palm forest
5	7°40.77'N, 58°57.70'W	near Moruka	floodeed palm forest
6	7°38.91'N, 58°55.80'W	near Moruka	floodeed palm forest
7	7°48.78'N, 59°03.30'W	Baramanni Lakes	flooded forest
8	7°46.09'N, 59°02.49'W	Baramanni Lakes	flooded forest
9	8°01.19'N, 59°13.45'W	Luri Creek	flooded mangrove forest
10	8°09.89'N, 59°29.02'W	Waini R.	flooded mangrove forest
11	8°20.27'N, 59°44.90'W	Waini R. near Mora Passage	flooded mangrove forest
12	8°09.45'N, 59°51.74'W	on road W. of Mabarauma	Secondary forest
13	8°12.76'N, 59°44.63'W	mouth of Aruka R.	flooded mangrove forest
14	7°56.04'N, 59°50.18'W	Obediah, Aruka R.	flooded/riparian forest
15	7°53.65'N, 59°50.23'W	S. of Obediah, Aruka R.	flooded/riparian forest
16	7°44.65'N, 59°34.03'W	mouth of Anabesi R.	flooded/riparian forest
17	7°41.90'N, 59°35.35'W	Barima R., near Anabesi mouth	flooded/riparian forest
18	7°49.91'N, 59°35.86'W	Anabesi R., above Moracot branch	flooded/riparian forest
19	7°52.51'N, 59°30.94'W	Moracot Branch, Anabesi R.	flooded/riparian forest
20	8°10.58'N, 59°40.78'W	mouth Kaituma R.	flooded forest
21	8°07.04'N, 59°40.32'W	Kaituma R., 5 km S. of mouth	flooded forest
22	7°46.10'N, 59°50.07'W	E. of Port Kaituma	riparian/terra firme forest
23	7°49.32'N, 59°48.43'W	Kaituma R., mouth of Sebai R	flooded forest
24		Manaca, on Essequibo R.	agricultural
25	6°36.69'N, 58°40.15'W	Goat or Groete Creek, off Essequibo R.	terra firme forest
26	6°11.40'N, 58°37.77'W	N of Marra, on Berbice R.	Agricult. /Ite palm savanna
27	5°45.78'N, 58°00.57'W	Weruni R., off Berbice R.	flooded/terra firme forest
28	5°45.72'N, 57°10.07'W	Corentyne R., near Crabwood Creek	agricultural/flooded forest
29	5°42.74'N, 57°10.35'W	Corentyne R., near Crabwood Creek	agricultural/flooded forest
30	6°38.23'N, 58°10.95'W	Garden of Eden, S. of Georgeotown	agricultural
31	5°48.18'N, 60°46.00'W	Waramadon, Kamarang R.	lower montane forest
32	5°49.44'N, 60°42.92'W	below Waramadon, Kamarang R.	lower montane forest
33	5°48.16'N, 61°03.81'W	Paruima, Kamarang R.	lower montane forest
34	5°50.20'N, 61°00.49'W	Kamarang R., below Paruima	lower montane forest
35	5°51.81'N, 60°36.86'W	Kamarang village	lower montane forest
36	5°54.39'N, 60°35.57'W	Mazaruni R., below mouth Kamarang R.	lower montane/riparian forest
37	5°43.05'N, 60°34.17'W	Mazaruni R., above mouth Kamarang R.	lower montane forest
38	5°43.65'N, 60°36.59'W	Kako savanna, near Kako village	lower montane forest/dry savanna
39	?	Mazaruni R., between Kako & Kukui R.	lower montane forest
40	5°43.11'N, 60°27.93'W	Mazaruni R., above mouth Kukui R.	lower montane forest
41	5°38.47'N, 60°27.52'W	Kukui R., above mouth	lower montane forest
42	5°42.21'N, 60°31.78'W	Mazaruni R., 5 km below mouth Kukui	lower montane forest
43	4°41.91'N, 59°42.84'W	Paramakatoi airstrip	savanna/montane forest
44	4°39.99'N, 59°42.85'W	4 km S Paramakatoi	montane forest
45	4°42.36'N, 59°41.86'W	2 km E Paramakatoi	montane forest
46	4°43.08'N, 59°44.05'W	3 km N Paramakatoi	montane forest
47	3°18.11'N, 59°38.99'W	MocoMoco, Kanuku Mts, E Lethem	terra firme forest/savanna edge
48	3°20.94'N, 59°48.57W	St. Ignatius, near Lethem	agricultural
49	3°17.60'N, 59°48.70'W	ca. 5 km S. St. Ignatius	dry savanna/gallery forest
50	2°24.15'N, 59°18.89'W	E. of Aishelton	dry savanna/gallery forest

count#	Coordinates	nearby landmarks	habitat
51	2°24.93'N, 59°22.49'W	W. of Aishelton	dry savanna/gallery forest
52	2°23.46'N, 59°17.41'W	Bush Mouth', E. of Aishelton	savvana edge/deciduous forest
53	2°31.27'N, 59°16.96'W	N. Aishelton	dry savanna/gallery forest
54	2°36.29'N, 59°14.83'W	near Awaranau	dry savanna/gallery forest
55	2°38.66'N, 59°12.90'W	near Awaranau	dry savanna/gallery forest
56	3°29.53'N, 59°33.08'W	Nappi village, E. of Lethem	gallery forest
57	4°11.53'N, 58°59.18'W	Iwokrama Forest, on main Road	terra firme forest
58	4°09.51'N, 59°03.49'W	Surama village, NE. Annai	terra firme forest
59	4°01.90'N, 59°02.16'W	W. of Wowetto village	terra firme forest
60	4°04.31'N, 59°03.33'W	N. of Wewetto Village on main road	terra firme forest
61	4°02.32'N, 59°03.83'W	N. of Wewetto Village on main road	terra firme forest
62	1°40.55'N, 58°37.36'W	Essequibo R., below Konashen village	terra firme/riparian forest
63	1°37.76'N, 58°37.41'W	Essequibo R., just above Konashen village	terra firme/riparian forest
64	1°39.13'N, 58°38.88'W	savannahs E. Konashen village	savanna/terra firme forest
65	1°36.09'N, 58°37.24'W	Essequibo R., 7 km above Konashen	terra firme/riparian forest
S1	?	near Wash Clothes, Mahaicony R.	agricultural
S2	6°19.67'N, 57°45.56'W	5 km. NE. of Wash Clothes	flooded savanna
S3	6°71.00'N, 57°37.48'W	near Marra, Berbice R.	agricultural/Ite palm savanna
S4	6°12.88'N, 57°32.94'W	near Ithaca	secondary forest
S5	6°09.33'N, 57°27.58'W	Canje Creek	secondary/riparian forest
S6	5°59.13'N, 58°33.04'W	Rockstone, Essequibo R.	terra firme/riparian forest
S7	5°46.83'N, 58°21.51'W	Bootuba, Demerarra R.	terra firme/riparian forest
S8	5°46.83'N, 58°21.51'W	5 km S. Bootuba, Demerarra R.	terra firme/riparian forest
S9	5°54.28'N, 58°19.30'W	5 km N. Bootuba, Demerarra R.	terra firme/riparian forest
S10	6°42.60'N, 58°36.21'W	Manaca, on Essequibo R.	agricultural
S11	6°34.02'N, 58°36.88'W	Saksaikali, Esqquibo R.	agricultural/riparian forest
S12	6°36.69'N, 58°40.15'W	Goat or Groete Creek, off Essequibo R.	terra firme forest