Appendix 4A

Bioassessment of the Cuyuni River near Aurora, Guyana, Environmental and Economic Implications, October 2009

BIO-ASSESSMENT OF THE CUYUNI RIVER NEAR AURORA, GUYANA,

ENVIRONMENTAL AND ECONOMIC IMPLICATIONS

DR NICOLE DUPLAIX

OCTOBER 2009

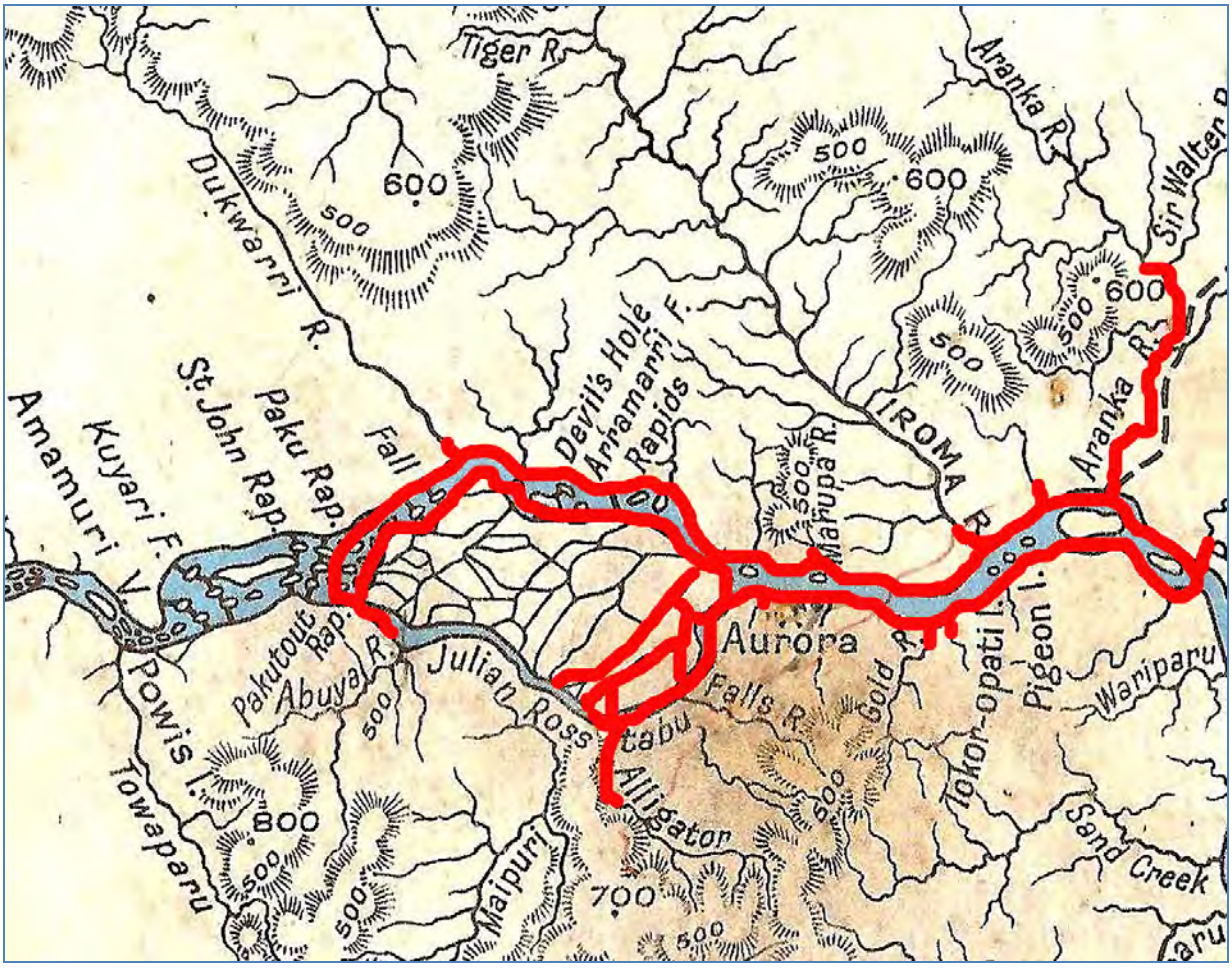
A Rapid Bio-Assessment of the Cuyuni River in the vicinity of Aurora, Guyana

Economic and environmental implications

Nicole Duplaix, PhD

Table of Contents

Map of Guyana (top) showing location of Cuyuni River (red arrow). Section of Cuyuni River surveyed (red line, below) in the vicinity of Aurora.



A Rapid Bio-Assessment of the Cuyuni River in the vicinity of Aurora, Guyana

Economic and environmental implications

Nicole Duplaix, PhD

A. Background: the Guayanan Shield

Like the Amazon River in Brazil, the rivers and wetlands in the three Guianas (Guyana, Suriname and French Guiana) hold the greatest concentration of freshwater biodiversity in the world. However, freshwater species and their freshwater biomes in the Neotropics are, on average, much more threatened than their terrestrial counterparts (Duplaix, 2002; Olson *et al*., 2001). The Guianas possess an extraordinary richness in biodiversity with 200 species of mammals, 674 species of birds, 152 species of reptiles, 99 species of amphibians and 790 species of fish (Mittermeier et al., 1990). The Guayanan Shield boasts several very important protected areas. These protected areas include the 60,000 km^2 Central Amazon Conservation Complex in Brazil, the 38,670 km^2 "*Montanhas de Tumucumaque*" National Park in Brazil, the 33,900 km^2 "*Parc Amazonien de Guyane*" in French Guiana, the 30,000 km^2 Canaima National Park in Venezuela, and the 16,000 km^2 Central Suriname Reserve in Suriname along with six other National Parks and National Monuments in the Guiana Shield that are larger than 10,000 km^2 (G. Watkins, pers. comm., 2009).

Many of the upper reaches of the major watersheds in the region are still pristine forests, such as the 1.6 million hectare Central Suriname Reserve in Suriname and the Kwitaro River near the Kanuku Mountains of Guyana (Montambault & Missa, 2002). Guyana is also one of the greenest countries in the world with an estimated 84 percent of its 214,970 square miles still covered with forests, and a low human population of 750,000 mostly living in the coastal region.

Governments in the three Guianas now face increased pressure to exploit their natural resources for short-term benefits. Gold and diamond mining are major industries in Guyana. Gold deposits in Guyana are mainly alluvial and buried under layers of sediments. The Mining Act was reviewed in 1997 with the granting of prospecting and mining licenses to the large-scale development of gold, diamonds and precious stones. Major foreign investors have entered into joint mining agreements with the Guyanese government and gold exploration ventures are booming. For instance, Guyana Goldfields' Aurora Gold Project has a resource of 5.4 million oz. with an initial high-grade (3 g/ton) open pit with underground expansion (6.5 g/ton). A projected yield of 275,000 oz per year over 15 years is anticipated. The project will be ready to start development in mid-2010 after completing their ESIA, DFS, permitting and project

financing. They are involved with the International Finance Corporation (IFC) of the World Bank Group for potential future financial assistance.

Large-scale gold mining activities are usually well-regulated ventures, but there are exceptions. Many will remember the 1995 Omai Gold Mines Limited (OGML) cyanide spill in Guyana. A tailings dam containing several billion liters of mining effluent from the milling factory breached. Over a four-day period, the tailings pond emptied its contents into the Omai River and subsequently the Essequibo River, at a rate of 90,000 cubic meters per hour (Vick, 1996). As the poison ceased flowing into the Omai River, a Pan American Health Organization (PAHO) expert declared it a "dead river," devoid of living organisms (PAHO Report, 1995). According to government estimates, approximately 23,000 persons lived within the environmental disaster zone.

Today the watersheds of the Guianas are facing a severe threat from another, parralel sector: the explosion of small-scale gold mining activities. Largely unmonitored and unregulated, they result in significant environmental and public health hazards due to chemical and environmental degradation. As part of the gold extraction process, mercury is used to form an amalgam with the gold to release it from its ore body. The amalgam is then burned to separate the mercury from the gold, and the poisonous mercury vapors are released into the environment. Mercury, a hazardous heavy metal, is readily available and can be purchased in large quantities throughout the Guianas. As a result of small-scale mining large concentrations of sediments are deposited in the rivers by dredging activity, high levels of mercury evaporate and seep into the watershed, multiple pools of polluted water dot the land, and large areas of forest are denuded. These types of damage have been recorded at the top of most of the watersheds in the region presenting severe long-term threats to the water quality of the rivers and creeks downstream and to all who depend on them. For instance, in the Commewijne River in Suriname, fish populations have been affected by the increase in turbidity, and the mercury levels that have skyrocketed to ten times the norm – as evidenced by the levels of mercury found in "amara" (*Hoplias* sp.*)* – a favorite fish of both people and otters (Qwik & Ouboter, 2000). Similar unsafe levels have also been found in sampling studies in Peru (Gutleb *et al.*, 1997), in Guyana (Singh et al., 1996) and in French Guiana (Richard *et al.*,2000).

Small scale, artisanal open pit gold mining has become commonplace in many South American countries: Peru, Brazil and the three Guianas to name a few. Brazil has outlawed this form of mining but it persists in the Guianas where so many rivers and forest creeks are remote and accessible only to the most determined. Dredges are used on larger rivers and the tailings form islands that remain clearly visible for years. The brazen activities of the miners, usually Brazilians, are clearly visible from the air as large swatches of forest are cleared and small creeks are used to channel the slurry downstream. Large camps and villages appear virtually overnight to the detriment of the indigenous populations whose fishing and hunting grounds are invaded and destroyed.). In 2003, the French army was sent to investigate the number of illegal Brazilian gold miners in the vast southern *Parc Amazonien de Guyane* and they estimated that over 40,000 of them had settled in this hitherto remote and inaccessible protected area (de Thoisy, pers. comm., 2003).

B. Project Description and Objectives

The focus of this survey was to establish whether there were any resident Giant otters (*Pteronura brasiliensis*) on the Cuyuni River, in the vicinity of Aurora. The endangered Giant otter is a top predator of the freshwater ecosystem food chain in the region and as such is a useful "umbrella species" to assess environmental degradation and to promote watershed protection and management. Further, Giant otters require large home ranges and can rapidly disappear from even remote river systems due to their pronounced sensitivity to increased human disturbance and their vulnerability to mercury accumulation. As such they are excellent "bio-indicators" too.

The River: The Cuyuni River, one of Guyana's main rivers, is 560 km long. Rising in the Venezuelan highlands, the river flows north, serving as a border between both countries for 100 km, before turning southeast through the gold belt, ultimately merging with the Mazaruni River before entering the Essequibo River near the town of Bartica. It is a main east-west transportation artery in an area where roads are virtually non-existent. Many creeks of various sizes and lengths are present. There are numerous rapids and cataracts in the section of the Cuyuni that was surveyed as the river tumbles rapidly down the rocky terraces of the Precambrian Shield. Usually these upstream waters of the major river system in the Guianas are black water or run quite clear and are loaded with oxygen but in this upper portion of the Cuyuni they are an opaque creamy brown color, loaded with silt.

Survey Objectives:

- To assess and monitor the health of a 40-kilometer portion of the Cuyuni River on either side of Guyana Goldfield's Aurora mine (see map).
- To locate and investigate local Giant otter populations.
- To provide baseline information on the riparian habitats and their biodiversity levels.
- To determine problematic areas in the surveyed area and to recommend the actions required to increase ecosystem health and resilience.

C. Giant otters as an Indicator Species, an Introduction

The ecology and behavioral repertoire of *Pteronura* have been described in detail in several major publications and we will only present a brief synopsis here (Duplaix, 1980,1982; Carter & Rosas, 1992; Groenendijk, 1995; Groenendijk *et al*., 2005).

The species: The Giant otter *Pteronura brasiliensis*, one of the larger carnivores of South America, is a primarily terrestrial mustelid that has become extremely well adapted to using an aquatic environment. Adult males measure up to 1.8 m and weigh 26-32 kg. , females measure up to 1.7 m and weigh 22-26 kg. This species lives in large, noisy family groups and shows little fear of humans (Duplaix, 1980).

Its status: Such a large, diurnal and gregarious animal makes an easy target for pelt hunters. Today it is the combined effects of habitat loss and the demands of the fur industry up to the mid-1970s that are responsible for *Pteronura*'s endangered status over much of its range in South America. Only in Suriname, where the local populations have never hunted it, the Giant otter enjoys relative security, particularly in the more remote rivers of the interior.

Habitat selection and seasonal requirements: Like many carnivores, Giant otters select their habitat according to prey abundance/availability/vulnerability criteria that may fluctuate seasonally (Duplaix, 1980, 1982). In Suriname *Pteronura* prefer slow-flowing clear black water creeks and rivers, particularly during the dry season when they prey heavily on fish that rest on the bottom in shallow water like amara (*Hoplias)* and catfish. The availability of preferred prey species in shallow water is the governing factor in *Pteronura*'s seasonal movements. Low sloping banks with good cover and close access to prime fishing areas are preferred by otters for their campsites where they rear their cubs. All these conditionsare met in Suriname both in Kaburi Creek and on the Upper Coppename River from mid-September to April during the dry season making them both ideal Giant otter habitats (Duplaix, 1980 and 2002, Duplaix *et al.*, 2001b). In Guyana, on the Rupununi River, the banks are much higher, >5m in some areas, there are fewer campsites and more dens, but fishing areas are equally good and otters are present in reasonable numbers (Duplaix, 2004).

Group structure and behavior: Giant otters are seen in groups ranging in size from two (a pair) to an extended family group of 7 or 8. Larger groups of 14 or more otters have been seen but these were probably two family groups traveling together. Solitary animals called 'transients', usually sub-adults, pass through an area but seldom remain for long (Duplaix, 1980).

Each family group clears a "campsite" along the bank and marks it with feces and urine, mixed with mud. The best sites, often perennial, are in key areas near fishing "ponds" or shortcuts avoiding a loop in the creek. These larger sites may have a den in the bank, and some even have backdoor exits into the forest or swamp away from the creek. Such sites

are often located on the only areas of high ground available, particularly in small creeks or in swamp forest. One group may use and mark several campsites in its territory and use several dens to rear its cubs.

Seasonal population dynamics: A family group of resident otters, along a creek or a river, occupies a territory at the height of the dry season. At this time they are usually raising their cubs, and they actively defend their territory using their campsites as scent marking stations. Each group clears “campsites” along the bank and marks them with feces and urine, usually trampled into the muddy substrate. The best sites, often perennial, are located in key areas of the territory: near fishing “ponds”, on the bends of a creek, near smaller creek entrances, or at “shortcut” paths on land avoiding a loop in the creek. Giant otters can be identified individually using the variation in white spots and blotches on their necks (see photo). Easy individual recognition is a great asset in determining territory boundaries and group movements up and down a creek.

D. Methods

Rapid bio-assessments are designed to quickly inventory the biodiversity of a given area. The information gathered in these surveys can be used to further our scientific knowledge in a given area and, ultimately, to make informed management decisions regarding land use. The methods used to conduct Giant otter surveys were devised by the researcher in her surveys in Suriname in 1976-1978 (Duplaix, 1980) and refined in 2002-2005 (Duplaix, 2001b, 2002, 2004; Groenendijk *et al.,* 2005).

Materials: A 10m-long wooden boat with a 75HP outboard was used for the majority of the survey days with two local boatmen familiar with the area. An 8m-long aluminum boat with a 15HP outboard motor was used for the first two days but proved unsuitable for work in the rapids.

Data Acquisition: Biodiversity assessments were made, using the river as a transect line as we progressed slowly by boat close to the bank on either side. Each creek was explored until fallen logs or debris blocked our way. All riparian vertebrate fauna seen or heard was identified (when possible) and a detailed list of the mammals and birds was kept. GPS locality data was noted for endangered species or species of special interest.

Otter data: As Giant otters are strictly diurnal all our observations are made during daylight hours. Each Giant otter site and/or den, along both riverbanks and in nearby creeks, is pinpointed by GPS and measured. Numbered metal tags and plastic flagging are left in place to identify each site and then site details are measured, sketched and recorded on data sheets. The data sheets are also used to record details on the otters, river (size, depth, color, turbidity, flow and level), bank vegetation type, and climactic condition so that the data obtained from different areas can then be compared and quantified.

If a Giant otter or group is sighted its location, group size, and behavior are noted on printed data sheets. The researcher attempts to follow the otters at a distance for as long as possible unless the otters show alarm – if so, the observation is stopped. No attempt is made to call to the otters or attract them. The following data are recorded: date, time (start and end), river system, GPS location, vegetation type, water flow and depth, water color and turbidity, bottom type, number of otters seen, presence/absence of cubs, presence/absence of dens, measurements of campsite and den(s), height of den above water, presence/absence of markings/latrines/claw marks and whether fresh or old, location, direction and activity of the otter(s) (in water, on land, swimming, resting), behavior of the otter(s) (approach, avoidance, alarm, indifference), vocalizations heard.

Human use and threats: Details are noted and photographs taken of any unusual circumstance or event, including human activities: deforestation, gold mining activity, commercial net fishing, natural fish kills, heavy motor boat use, presence of hunters not belonging to local communities, wildlife collectors and/or tourists. The data obtained in this manner provide an assessment of both the presence/absence of Giant Otters and the level of human use in a form that can be readily quantified and compared.

E. The Itinerary, Survey and Findings

It must be underlined, at the onset, that this ten-day *very* rapid bio-assessment of a 40 kilometer stretch of the Cuyuni River on either side of the Aurora mine was superficial in nature. Usually bio-assessments involve a team of experts and take weeks of effort.

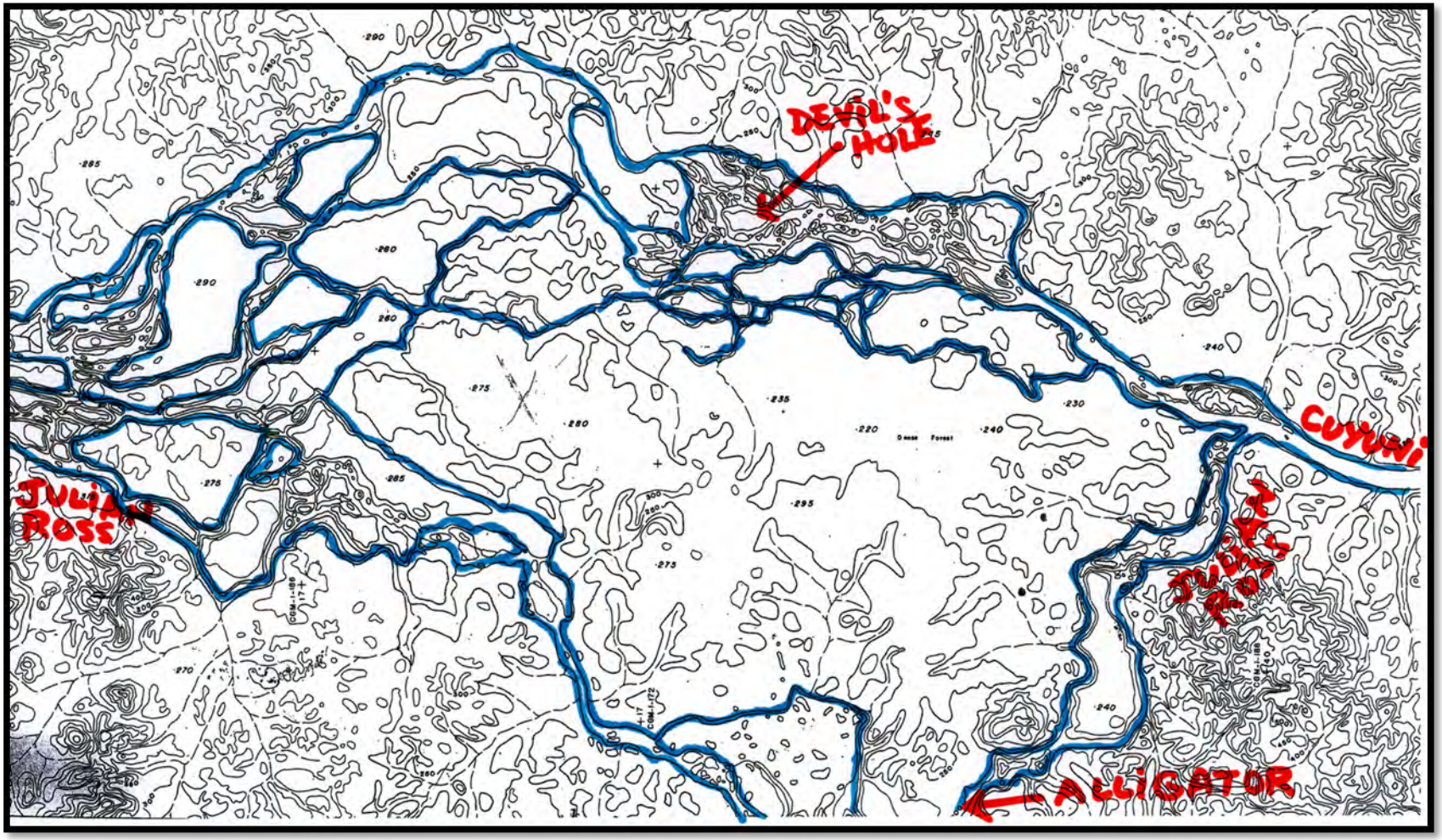
The Itinerary:

- October 13: Interview Aurora personnel and organize transport.
- October 14: Upstream. Survey of Julian Ross River and Alligator Creek
- October 15: Downstream Cuyuni River. Survey islands, entrances of Roma Creek and Aranka Creek.
- October 16: Upstream. Survey Cuyuni River and plateau complex.
- October 17: Upstream. Julian Ross to waterfall barrier and Alligator Creek.
- October 18: Upstream. Cuyuni River to Devil's Hole, Kuyari and upstream entrance of Julian Ross River.
- October 19: Downstream. Aranka Creek up to Arangoy village.
- October 20: Upstream. Julian Ross and plateau complex.
- October 21: Downstream. Cuyuni River down to Itabu Island and to Rupa Creek
- October 22: Tour of Aurora mine.

The Survey:

1. ***Aurora to Julian Ross River:*** The Cuyuni River, a few kilometers above Aurora, divides into two large rivers: the Julian Ross River on the southern side and the Cuyuni on the north as the river broadens into a plateau, with multiple rapids, creeks and forested islands (See map). This wide granitic plateau covers a stretch approximately 20 km long all the way to the Paku Rapids upstream where the Julian Ross rejoins the Cuyuni. The Julian Ross is a river with high forested clay banks and multiple narrow creeks which, potentially, would be excellent otter habitat. In Aurora, I received a report that an otter had been sighted on the Julian Ross recently (R. Ambrose, pers.comm.) but was unable to determine whether it was a Giant otter(s) or a Neotropical otter that has been sighted. Otters of both species, called 'transients', may travel 50km or more in search of a mate or a new territory without becoming permanent residents. Transients may be seen once and

Map of the Julian Ross-Devil's Hole plateau river complex west of Aurora. Note large number of islands and creeks. Rivers are transected by rapids and waterfalls in many places.



Riparian and pre-montane forest at Aurora airstrip bordering Cuyuni River (Oct.13.09)

Rocky outcrops in Cuyuni River east of Aurora. Note silt-loaded water (Oct.13.09)

Illegal artisanal gold mining in forest near upper Aranca creek. Note extent of slurry ponds. (Oct.13.09)

Small forest creek near downstream entrance of Julian Ross River. Note silt-loaded water. (Oct.14.09)

Rocky outcrops just below Devil's Hole on upper reaches of Cuyuni, very similar in appearance to the Upper Coppename River (Central Suriname Nature Reserve), a pristine area in Suriname. (Oct.18.09)

Rapids in rocky area below confluence of Cuyuni and Julian Ross rivers. This is a plateau with many small islands, creeks and outcrops which is, potentially, excellent otter habitat. (Oct.14.09)

never seen again. They usually do not leave signs such as scats or, in the case of Giant otters, clear campsites – signs which remain visible for a long time.

At least five mining camps are present on the river's edge at the downstream end of Julian Ross and at least one mining camp is located on Alligator Creek further upstream. Old, abandoned mining camps are also visible along the banks. Without aerial surveys and further reconnaissance into the forest itself it is difficult to determine the exact number of these temporary camps and the extent of the artisanal mining operations. Silt-loaded waters running out of the forest creeks (N 6.44.301' W 59.50.040'), particularly in Alligator Creek, and into the Julian Ross are clearly visible indicating intense mining activity upstream, unfortunately these narrow creeks are filled with fallen logs that bar access.

Few large birds were observed which is very unusual in this type of dense forest habitat and may indicate heavy hunting pressure, past or present. For instance, Red and green macaws (*Ara chloroptera*) and Cocoi herons (*Ardea cocoi*) were both only seen twice on three inspections of this river system. Smooth-fronted caiman (*Paleosuchus trigonatus*) were seen twice resting on logs near the bank. The access to the upstream portion of Julian Ross is barred by a waterfall-rapids complex, soon after the entrance to Alligator Creek.

2. ***Aurora to Devil's Hole and beyond.*** The northern branch of the Cuyuni continues in a westerly direction through a series of winding granite waterfall-rapids complexes that makes navigation slow and hazardous. Evidence of past dredging activity is visible with frequent tailing islands of an alluvial gravel and sand mix. Some of the larger tailing islands have >4m-high stands of Brazilian pepper (*Schinus terebinthifolius**)*** and/or Water guava (*Psidium*) growing, both invasive species, that indicate that dredging activity occurred there years ago. The nature of these tailing islands composed of sand and alluvial gravel are in stark contrast to the normal sand-only bars that are also present when the river flows through portions of Roraima sandstone habitat.

   We found two old, single otter scats on boulders in the side channels of this portion of the Cuyuni River. These were Neotropical otter (*Lontra longicaudis*) scats, containing fish and crab remains. Return visits over a ten-day period failed to find fresher scats, which indicates that the otter was probably not a resident. Also, if several otters were present in the area, several scats would be deposited in the same location, often on the same boulder (Duplaix, 1980, 2002). Neotropical otters leave scats on logs or boulders in larger rivers, usually during the dry season, but spend most of their time in smaller river creeks.

   Further upstream there is a granite boulder plateau with numerous small islands that is reminiscent of the habitat on the Upper Coppename River in the Central

Suriname Reserve in Suriname. Both areas are excellent otter habitat and Giant otters are frequently sighted on the Upper Coppename, but Giant otters are absent from this stretch of the Cuyuni. Again there were very few larger birds present whereas they would be numerous in the pristine areas of the Upper Coppename. For instance, the usually ubiquitous smaller parrots such as Black-headed parrots (*Pionetes melanocephala*) and Orange-winged Amazons (*A. amazona amazonica*), both very common species often seen in flocks, were only spotted once as single individuals. Wildlife is an important export of Guyana and I fear that the parrots of this region may have been overharvested in the past (Duplaix, 2001a).

Devil's Hole is an island located two hours upstream from Aurora. It serves as a cross-over point to a southern channel of the Cuyuni. There are many waterfall and rapids that bar the access in the main channel, forcing people to transfer their boats and their contents overland. This large island has been virtually denuded and is now populated with Brazilian and Guyanese boatmen and merchants. There is a small food shop, a few shacks for the residents, an outboard repair facility as well as drums of fuel available. Piles of rubbish and plastic bottles are everywhere. Boats of varying sizes are available for hire for people wanting to continue upstream towards Venezuela.

Just above this cross-over point in the southern channel of the Cuyuni there are four houseboats present and three dredges, one in operation. The rapidly expanding Kuyari mining village is located one hour upstream, which has expanded from about 10 families four years ago to over a hundred families today, mainly Brazilian miners. The miners are specialized in dredge mining on this stretch of the Cuyuni. Large Brazilian metal boats used to ferry fuel and supplies are pulled up along the banks. Kuyari village is halfway between Devil's Hole and the upstream entrance to the Julian Ross River. At that juncture there are three more dredges, two of which are in operation. Dredge tailing piles are frequent all along this stretch of the river.

We did not survey the river past the top (western entrance) of Julian Ross. Our boat captain, who often travels upstream to Venezuela, mentioned that he saw Giant otters sometimes well above the Amamuri Falls, a section of the river that is not being dredged currently, but he added that he had not seen them for at least five years.

3. ***Roma and Aranka Creeks.*** The Cuyuni River downstream of Aurora is wide and flows more slowly. There are several large islands, some vegetated, with high banks. Sand bars and sand-gravel tailings mounds are also present. Granite outcroppings are visible at this time of year when the water levels are low.

   Roma Creek (N. 6.48.229' W 59.40.268') is a large black water forest creek on the north bank that, unfortunately, is soon barred by fallen logs making access

Silt-loaded water of a forest creek flowing into Alligator Creek, a tributary of the Julian Ross River, indicating presence of illegal mining activities upstream. (Oct.14.09)

Entrance of Aranca Creek, a tributary of the Cuyuni River with many illegal surface mines present upstream. Note color of water flowing out of creek (right) into the Cuyuni (left) (Oct.15.09)

Large notch in bank of Upper Aranca Creek, draining thick slurry from artisanal surface mining operation directly into the creek (Oct. 19.09)

Dredge damage on Upper Aranca Creek – same location as photo on left (Oct. 19.09)

Even large, heavy boats are used on narrow Aranca Creek, damaging the banks and the creek bed (Oct. 19.09)

Trash and large debris are present on the entire length of Aranca Creek (Oct. 19.09)

impossible. The water flowing out of the creek is muddy and silt-laden which indicates mining activity upstream.

Further downstream, Aranka village (N 6.49.687' W 59.37.470') is located on a large island opposite the opening of Aranka Creek. Like Kuyari, this small village is expanding rapidly as Brazilian miners settle in Aranka Creek and use the village as a stop off point. Fuel drums, some of them leaking, are stored in the river as the banks here are steep.

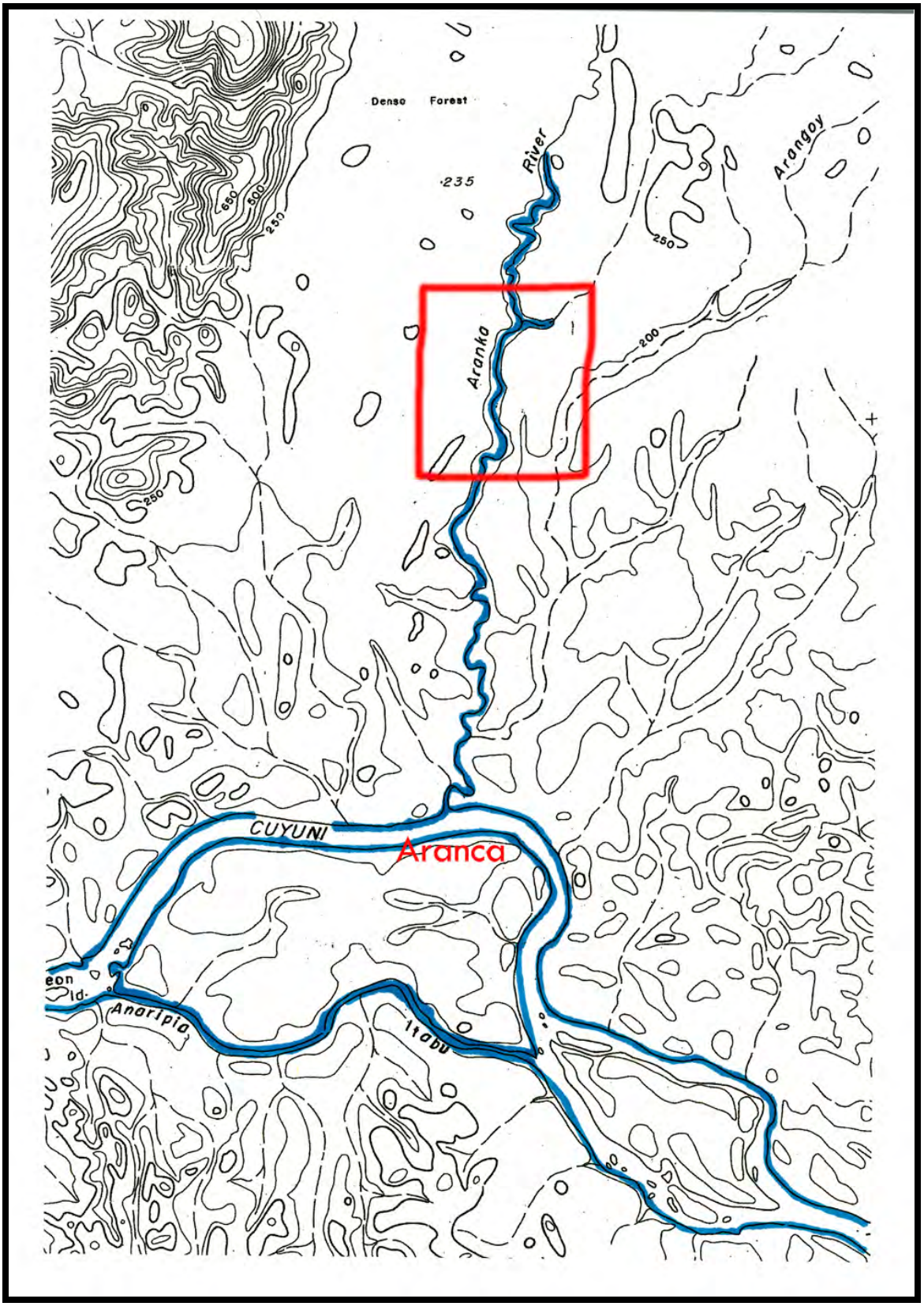
One fisherman told me that fishing with 50m-long nets in the Cuyuni produces very few fish and that the heavy boat traffic often destroys his nets. Other residents complain that both hunting and fishing have declined dramatically in the last three years when the miners moved in. Yet the villagers do a brisk trade selling supplies to the miners in Aranka Creek at sometimes 100 times the price paid in Georgetown. The miners in the upper reaches of Aranka Creek, far removed from supplies, are happy to pay by the gold penny weight (US $50): two penny weight for a small fish (US $100), two ounces of gold for a small wooden boat (US $2,000) and 6-7 penny weight (US $350) for a drum of fuel which costs only US $10 in Venezuela! Several Aranka boatmen regularly make the journey upstream to Venezuela to ferry fuel drums to the miners.

Aranka Creek discharges silt-loaded waters that contrast with the darker waters of the Cuyuni. This long forest creek is composed of floodable low forest at the entrance and mesophytic rain forest further upstream. Heavy boat traffic is constant in the creek. The narrow metal boats loaded with fuel and supplies, zoom up and down, narrowly missing each other as the creek is narrow in places. Debris, plastic bottles and abandoned boats litter the creek along its entire stretch (see photo). Again there were few birds in a forest creek habitat that usually abounds in birds. We saw a single Green-and-rufous kingfisher (*Chloroceryle inda*), a common forest creek resident. We saw one live Smooth-fronted caiman (*Paleosuchus trigonatus)* and one dead one, which may have been hit by a boat.

Mining activity on Aranka creek becomes visible about halfway to Arangoy village. There are wide notches in the banks that are used to empty the slurry ponds directly into the creek (N 6.53.319' W 59.36.687'). There appears to be little or no effort to abide by the Guyanese surface mining regulations (see photos). We counted eight mining sites, visible from the creek, and there are probably more in the forest nearby. Two mining sites appeared to be abandoned, leaving behind large deforested areas with empty settling ponds (N 6.54.120 W 59.36.715) and piles of debris.

Our survey area stopped at the entrance of Rupa Creek below Aranka village (map). A large dredge was present and in operation (photo). The alluvial gravel tailings were extensive, stretching nearly halfway across the river.

Map of Cuyuni River showing length of Aranca Creek. The major damage from illegal gold mining activities, from both surface dredging and excavation, occurs in the top reaches of Aranca Creek (red square). Blue line is area surveyed.



Amara (*Hoplias*) caught in a net on Cuyuni near Aranca village, later sold to a Brazilian on Upper Aranca Creek for two penny weight of gold (US $100). Locals report that here are no large food fish left in polluted Aranca Creek. (Oct.19.09)

Leaking fuel barrels on Cuyuni River at Aranca Village. Local boatmen ferry fuel barrels from the Venezuelan border on the Upper Cuyuni. There, three barrels of fuel cost US $30 which are then sold to miners in Aranca Creek for one ounce of gold (US $ 1,000).(Oct.19.09)

Brazilian miners at the downstream entrance of Julian Ross River. Four illegal mining operations were seen in Julian Ross and there are probably more. (Oct.20.09)

Dredge operated by Brazilians at upstream entrance of Julian Ross River, one of three present in the immediate area. Many alluvial gravel dredge piles are present. (Oct.18.09)

Rapidly expanding village of Kuyari above Devil's Hole on the Cuyuni. Its is now predominantly Brazilian. (Oct.18.09)

Dredge on Cuyuni River below Aranca Creek. Note size of alluvial dredge pile. (Oct.21.09)

Comparison with other areas: At the start of this bio-assessment I was struck by the similarities in appearance between the Cuyuni River in the Julian Ross-Devil's Hole area and the upper Coppename River in Suriname. While the latter is a pristine area in the 1.6 million hectare Central Suriname Reserve and a UNESCO World Heritage site, the Cuyuni River has been heavily exploited for many decades, yet in appearance, they are remarkably similar. Both have Precambrian granitic outcroppings forming small island complexes spread over a large plateau, transected by rapids and waterfalls. Primarily lowland and pre-montane tropical moist mesophytic forest are dominant habitat features in both areas. Small creeks zigzag through the forest on either side of the river.

The upper reaches of the Coppename River above Raleigh Falls remain pristine and virtually undisturbed. The biodiversity is exceptionally high with many rare species represented. There is no adverse human activity except for occasional fishing and hunting expeditions by local people living downstream. As a result many large vertebrates are quite common and easily seen: Giant otters, jaguar, puma, tapir, peccaries, caiman, harpy eagle and capybara.

Further, some of the smaller tributaries of the Cuyuni like Alligator Creek, Roma Creek and Aranka Creek all bear superficial resemblance to many other narrow forest creeks I have studied in Guyana and Suriname (Duplaix 1980, 2001b, 2002). Forest creeks like Kaburi Creek, Suriname and the pristine Upper Kwitaro River, Guyana, are similar in appearance to parts of Aranka Creek on the Cuyuni, but have high biodiversity levels and a very rich bird life. (Duplaix, 2002; Montambault *et al.*, 2002)

Findings:

Biodiversity. The results of this mini assessment illustrate the impacts of unregulated artisanal mining activities on a fragile ecosystem. The usual vertebrate fauna found in pristine riparian zones and along forests creeks in the Guianas was missing or extremely low – gone was the dawn chorus of parrots, gone the primates in the canopy, gone the kingfishers and herons flying past.. Instead, an eerie silence reigned day after day. Most species were only sighted once or twice instead of many times a day. Only the smaller mid and upper canopy forest birds were present in reasonable numbers – cotingas, hummingbirds, honeycreepers, flycatchers. Of the larger mammals, tracks of tapir (*Tapirus terrestris*) were seen once at the entrance of Aranka Creek and capybara (*Hydrochaeris hydrochaeris*) twice near Aurora. Old scats of Neotropical otter (*Lontra longicaudis*) were found twice on boulders midstream. Red howler monkeys (*Alouatta seniculus*) were heard once in the distant premontane rainforest on Alligator Creek and three Wedge-capped capuchins (*Cebus olivaceus*) were seen once in the riparian forest near Roma Creek on the Cuyuni. Smooth-fronted caiman (*Paleosuchus trigonatus*) were seen eight times both on the river and in creeks, the most frequent sighting of any large vertebrate.

The absence of otters. Signs of Giant otters, old or new, were absent in a habitat that seemed ideal for them in the area surveyed on the Cuyuni and its tributaries. We heard

The endangered Giant otter is usually seen in family groups. Each otter has an individual pattern of spots on its neck. No evidence of its presence was found.

The smaller Neotropical otter is usually solitary. It occurs in the Cuyuni-Julian Ross river complex which has excellent otter habitat.

Giant otter groups clear areas of the bank to mark their territory and use them as campsites. No campsite was found in this area of the Cuyuni River.

Old Neotropical otter scat on boulder in the Cuyuni-Julian Ross river complex. (Oct.14.09)

Smooth-fronted caiman in Cuyuni-Julian Ross river complex was the animal most often seen. (Oct.18.09)

Capybara tracks seen in swamps of Aurora mine where no hunting is allowed. (Oct.15.09)

reports of the presence of Giant otters, reported as “rarely seen,” much further upstream from the Devil’s Hole river complex.

Colonizing a vacant river or re-colonizing vacant portions of a disturbed river is not straightforward. Once Giant otters have abandoned a river (or, worse, a watershed) or been extirpated by hunters, pollution or disturbance this creates a gap that must be found within a limited time frame by transient otters seeking territories. It is unlikely that such young, inexperienced animals, would find an adjacent empty river or watershed that would involve long and dangerous overland exploration. Their chances of exploring the river they know appear to be higher.

In Peru, Schenk and his colleagues, created a model to test the likelihood of a transient otter meeting a mate at the right time in the right place *and* finding an empty territory (Duplaix, 2002, Schenk *et al.*, 2002). First, there must be a reasonable number of transients in a given river looking for mates each year. Second, each group must have a minimum number of cubs surviving in order to have a minimum number of transients available. High cub mortality, due to predation, disease or collecting by humans, will have a direct effect the number of transients that will set out on their own. This ‘colonization potential’ by transients is clearly the vital key to the long-term viability or collapse of a Giant otter population on any given river in the Guianas just as it is in Peru. If the population numbers are high enough to withstand accidental loss of cubs or transients all is well and the resident population may even expand. The more resident otter groups breed each year means the more subadults must leave their groups to find new territories to colonize.

The more transients on the river each year looking for a mate, the higher the probability of success and the quicker a territory is created or re-occupied. If, through attrition, pollution or accidental loss, the otter population number falls below a certain critical level or, if the population becomes too isolated geographically from the next nearest group of resident otters, the transients will not be able to reach it in time, and in that case the collapse of the population is inevitable because there is minimal likelihood that transients will meet or find mates. Establishing the minimum number of transients needed each year to insure the long-term viability of the Giant otter population in a given watershed is difficult to determine as it probably varies with the type of river system and how many potentially attractive empty territories are available and how far they are apart from each other. The most important factor in ensuring survivability is *preventing* increased Giant otter mortality due to anthropogenic factors that may trigger the irreversible population collapse of this endangered species in one river system after the other.

Illegal surface gold mining. Small-scale artisanal gold mining is now illegal both in French Guiana and in Brazil, with Suriname not far behind, which may explain why so many Brazilian are moving to Guyana, knowing that they will not be controlled or turned away. I fear, that due to the rising price of gold (currently $ 1,045 per ounce), the same meteoric rise of illegal mining activity will continue on larger rivers and even in remote areas of the isolated upper watersheds in the gold belt of all three Guianas. Such unsafe concentrations of mercury present in the water, fish and sediments pose a serious threat to

both humans and the wildlife that depend on fish for their survival. Finally, the large-scale illegal export of gold, such a precious resource, impacts Guyana's economy.

Recommendations

1. Conduct detailed bio-assessments as soon as possible to assess and measure actions that have degraded the Cuyuni River ecosystem in the riparian corridor and in larger forest creeks using aerial surveys, water quality and sediment analysis, and biodiversity surveys. Continue to monitor biodiversity levels at regular intervals.

2. Recommend strict mining guidelines and regulatory structures that are enforceable by well-trained and motivated mining inspectors and law enforcement officials to curtail illegal surface mining and dredging by Brazilian immigrants.

3. Curtail the illegal export of gold to neighboring countries through inspections at border crossings, such as the bridge in Lethem.

4. Impose post-surface mining environmental restoration activities as a mandatory requirement of concession allocations and the issuance of all small-scale and large-scale mining permits.

5. Establish monitoring protocols in various key habitats that are particularly vulnerable to mining activities, particularly in forest creeks, to curtail unregulated mining activities.

6. Monitor the mercury levels in preferred food fish species and in local residents using hair and urine samples. Establish local outreach and education programs concerning the health risks of exposure to mercury and the dangers of eating certain fish species prone to mercury accumulation, such as the favored “amara” (*Hoplias* species)

7. Steps to stop such unsafe artisanal gold mining practices with mercury releases in the rivers and forest creeks *must* be taken soon to protect both humans and wildlife.

G. Conclusions

This survey was far too short and superficial in nature to pinpoint and evaluate all the threats to this small portion of the Cuyuni River and to the entire river system. The one action recommendation that I will make is that a more detailed Cuyuni River bio-assessment needs to be done soon to obtain meaningful data that could lead to better law enforcement and conservation measures.

I will underline what this and other surveys in the region have established: the three Guianas and the Pantanal in Brazil remain the *last* strongholds of Giant otters in South America, with pristine Giant otter habitat on some rivers and good Giant otter densities overall – still, but for how long? The survival of the Giant otter populations in the Guianas is essential to the survival of this endangered species in South America, but threats are growing more widespread and the Cuyuni River is but one example. No Giant otters were seen in the portion of the Cuyuni River we surveyed and no traces of their presence were observed. While transient otters have been reported, Giant otters have probably not been residents in this portion of the river and its tributaries for at least four years or more.

Can Nature heal? The extent of the damage to the Cuyuni River after decades of dredging and the extent of recent surface mining damage in the rainforest tributaries is considerable and profound. The effects of high sedimentation levels, turbidity and the magnitude of the mercury pollution are severe problems that cannot be reversed or repaired quickly in any river system. The high price of gold on world markets, the accelerating invasion of illegal Brazilian gold miners to this area and the lack of enforcement of Guyanese mining and health regulations in the Cuyuni river basin – all point to a long-term loss of ecosystem function and severe health problems for the local and indigenous populations living there.

Acknowledgements

The consultant expresses her sincere thanks to Environmental Resources Management (ERM) and Dr. Robert Langstroth for suggesting this rapid bio-assessment survey of the Cuyuni River around Aurora. Guyana Goldfields, Inc. provided financial support and assistance for this project. I would also like to thank Violet Smith, Country Manager, Guyana, and Chris Robinson, Operations Manager, Canada, who provided valuable logistical support and assistance in planning the trip. The personnel at the Aurora mine were particularly helpful during my stay and I would like to recognize in particular Lionel Marks, Michael Williams, Mark Davis and Anthony Caines who made this project such an enjoyable experience.

References

Alonso, L.E. and H.J. Berrenstein (eds.), **(2006).** A Rapid Biological Assessment of the Aquatic Ecosystem of the Coppename River Basin, Suriname. *RAP Bulletin Assessment 39*. Conservation International, Washington, D.C. 111 pages

Barnett, A., Shapley, R., Lehman, S., Henry, E. & Benjamin, P. (**2000**). Records of the Giant Otter, *Pteronura brasiliensis*, from Guyana (Final version). IUCN Otter Spec. Group Bull. 17(2) 2000; pp. 65-74

Carter, S.K. & Rosas, F.C.W. (1997). Biology and conservation of the Giant Otter *Pteronura brasiliensis*. *Mammal Rev.* 1997, Vol. **27**, No.1, pp. 1-26

Duplaix, N. (1980). Observations on the Ecology and Behavior of the Giant River Otter (*Pteronura brasiliensis*) in Suriname. *Rev. Ecol. (Terre Vie),* vol. **34** (1980); pp. 496-620 Downloadable www.giantotterresearch.com.

Duplaix, N. (1982). *Contribution a l'Ecologie et a l'Ethologie de Pteronura brasiliensis (Carnivora, Lutrinae): Implications Evolutives*. Doctorat Thesis, U. of Paris-Sud, 352 pp.

Duplaix, N. (2001a). Evaluation of the Animal and Plant Trade in the Guayana Shield Ecoregion, Preliminary Findings. *World-Wildlife Fund and UNDP Guayana Forests & Environmental Conservation Project (WWF-GFECP) 2001*. 88pp. Downloadable www.giantotterresearch.com.

Duplaix, N., M. Lingaard, & C. Sakimin (2001b). A Survey of Kaburi Creek, West Suriname and its Conservation Implications, *Report to the Oceanic Society*, 34 pp Downloadable www.giantotterresearch.com.

Duplaix, N., (2003). Giant Otter Final Report. WWF-Guianas Rapid River Bio-Assessments and Giant Otter Project, FG-40 FY2002. 230 page mimeo report. Downloadable www.giantotterresearch.com.

Duplaix, N., (2004) Guyana Giant Otter Project, 2002-2004 Research Results. Report to the Oceanic Society, San Francisco, CA. 40 pages.

Forte, J. (1998). Impact of the gold industry on the Indigenous peoples of Guyana. In Cantebury, D. (Ed.). Guyana gold's industry: Evolution, structure, impacts &non-wage benefits. Institute of Development Studies.Turkeyen, Greater Georgetown, Guyana.

Gómez, J.R. & Jorgenson, J. (1999). An Overview to the Giant Otter – Fisherman Problem in the Orinoco Basin of Colombia. *IUCN Otter Spec. Group Bull.* 16(2)1999; pp. 90-96

Groenendijk, J. (1998). A Review of the Distribution and Conservation Status of the Giant Otter (*Pteronura brasiliensis*), with Special Emphasis on the Guayana Shield Region. Commissioned by the International Fund for Animal Welfare, produced by the Netherlands Committee for IUCN, March 1998; 55pp.

Groenendijk, J., Hajek, F., Duplaix, N. *et al.* **(2005)** Surveying and Monitoring Distribution and Population Trends of the Giant Otter (Pteronura brasiliensis). *Habitat* 16. 100 pp. Downloadable www.giantotterresearch.com.

Gutleb, A.C., Schenck, C. & Staib, E. (1994). Giant Otter (*Pteronura brasiliensis*) at Risk? Total Mercury and Methylmercury Levels in Fish and Otter Scats, Peru. *Ambio* Vol. 26 No. 8, Dec. 1997; pp. 511 - 514

Gutleb, A.C., Schenck, C. & Staib, E. (1993). Total Mercury and Methylmercury Levels in Fish from the Department Madre de Dios, Peru. *IUCN Otter Spec. Group Bull*. **8**/1993; pp. 16-18.

Jacques, H., Pelsy, C., de Thoisy, B. (2000). La loutre géante en Guyane Française : *Rapport de mission sur le Litani.*
Jacques, H., Pelsy, C (2001). La loutre géante en Guyane Française : *Rapport de mission sur l'Aratai.*
Mittermeier, R.A., S.A. Malone, M.J. Plotkin, *et al*. **(1990).** Conservation Action Plan for Suriname. Conservation International, Suriname Forest Service, World Wildlife Fund-USA, STINASU. 45 pp.
Montambault, J.R and O. Missa, eds. (2002). A Biodiversity Assessment of the Eastern Kanuku Mountains, Lower Kwitaro River, Guyana. *RAP Bulletin Assessment 26*. Conservation International, Washington, D.C. 86 pages
Olson, D.M., Isola, S.E., Cogliano, M., Thieme, M.L. & Mobley, M. (2001). Designing a representative network of protected areas for giant otters (*Pteronura brasiliensis*) and other Neotropical freshwater megafauna. *WWF-US Report*. 17 pp.
PAHO (1995) Omai Gold Mine Ltd. Cyanide Spill: Disaster Assessment Report by Eng. Tom Vlugmen, PAHO/WHO Health and Environmental Advisor. Georgetown, Guyana
Quik, J.A.M., P. Ouboter (2000). Water Quality Monitoring in the Commewijne Watershed, Suriname.*World-Wildlife Fund and UNDP Guayana Forests & Environmental Conservation Project (WWF-GFECP) 2000*. 88 pp
Richard, S., Arnoux, A., Cerdan, P., Reynouard, C., Horeau, V. (2000) Mercury levels of soils, sediments and fish in French Guyana, South America. *Water, Air, and Soil Pollution* 124: 221-244.
Schenck, C., Groenendijk, J., Hajek, F., Staib, E., & Frank, K. (2002) Linking Protected Area Conditions to Species Needs. In, *Landscape Ecology and Resource Management, Linking Theory with Practice*, eds. J.A. Bissonette & I. Storch. Island Press. Pp. 341-357.
Singh, D., C. Watson, S. Mangal (1996) Identification of the Sources and Assessment of the Levels of Mercury Contamination in the Mazaruni Basin in Guyana, in order to Recommend Mitigation Measures. Institute of Applied Science and Technology report to the WWF-Guianas. 10 pages.
Vick, S.G., (1996) Tailings dam failure at Omai in Guyana. *Mining Engineer*.48. 11.34-37. 1996