FIELD REPORT - Amazon Riverboat Exploration

Project scientists

Dr. Richard Bodmer

Country

Peru

Research site / region

Samiria River, Pacaya-Samiria National Reserve

Research site latitude / longitude

E 857949, N 9503866

Protected area status

Samiria River: National Reserve

Date field report completed

17 Feb 2011

Period covered

1 Jan 2010 to 31 Dec 2010

Report completed by

Richard Bodmer

DICE
UNIVERSITY OF KENT

Dear Volunteers,

I am very pleased to inform you of the tremendous successes in the data collection of the *Amazon Riverboat Exploration* Earthwatch project in the Peruvian Amazon. The information you helped collect is clearly showing the impact of climate change here in the Amazon. 2009 saw the highest water level in recorded history and 2010 the lowest. The data you helped collect are showing how these variations are impacting the wildlife of the Samiria River basin, both positively and negatively.

At the Samiria site the conservation-based research is resulting in real and significant advances for the wildlife, wild lands and local people. Your dedicated and enthusiastic help during the project has made a real difference. The Samiria site has shown increasing populations of key wildlife species, including the woolly monkey, black caiman, giant river otter, and turtle, among others. The dolphins, macaws, and terrestrial wildlife are abundant in the Samiria river system and help us understand the impact of climate change in this system. Conservation and management recommendations are being incorporated as a result of the Earthwatch expeditions. The research has clearly shown that conservation actions are more complex than originally thought and the impact of global climate change needs to be incorporated into the long term monitoring of the flooded forests.

Thanks to your help we can now better evaluate the impact that global climate change is having on the Amazon forests. The Pacaya-Samiria National Reserve and other Amazonian protected areas will need to incorporate management actions as the impacts of global climate change on these delicate habitats are more fully understood. It is also clear that management of the protected areas requires active participation of local indigenous communities, and the important role they play as stewards of the rainforest. In the coming years we will work closely with Earthwatch, the reserve administrations, local people, students and fellow researchers to advance the conservation of the Amazon forests, using the Samiria as our case study site.

Again, thanks so much for your kind assistance with the Amazon Riverboat project.

Yours faithfully,

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SECTION ONE

Top highlight from the past field season

The Amazon basin is going through dramatic climate changes that will impact the largest rainforest on Earth. This year the water level of the Amazon River was at a historic low resulting in extremely dry conditions. Last year the same river was at a historic high, flooding huge areas of Amazonian forests. Each year the Amazon River goes through seasonal changes between the flooding period from December to June and the low water period between July to November. However, these normal seasonal changes are now becoming more intense, which is impacting the wildlife and local people.

Normal cycles in the Amazon forests are now being disrupted by the extreme flooding and drought events that are occurring. The flooded forests of the Samiria River are particularly important at understanding the impacts of climate change in the Amazon, since the aquatic and terrestrial interface between high and low water seasons makes this habitat sensitive to greater seasonal variations.

The extreme low water conditions of 2010 resulted in lower dolphin numbers throughout the Samiria River. The fish were impacted by the extremely low water levels and many left the Samiria River for the larger water bodies of the Amazon River. The spectacled caiman was impacted by the extreme low water levels, whereas the black caiman did not appear to be affected. The low water appears to have impacted the smaller macaw species, especially the Chestnut-fronted Macaw. Last year during the extreme flooding the deer, peccaries, rodents and tapirs had a very difficult time. They were forced to find small levees or floodplain islands to take refuge from the extensive floods. Their numbers decreased last year due to the opposite (dry) conditions from this year. The low water conditions that are currently happening may actually allow their numbers to increase as they have much greater areas to find food now that much of the flooded forest is dry.

The local Cocama Indians have had to adjust their livelihoods to the current conditions. Usually, during the low water season people rely on fishing for their food and income. However, the Samiria River became so low that most of the fish have either died or left and the local people are experiencing a more difficult time than usual. The bush meat species such as the deer and peccaries became fewer during the extreme floods of 2009, and in 2010 the fish populations are lower because of the drought. These combined effects of climatic change are clearly impacting how the Cocama people live, since their daily lives depend on bush meat and fish for subsistence. Fortunately, there are still enough fish and wildlife in the Samiria because of the conservation actions by the local people over the past decade. However, if the extreme climatic events continue both the wildlife and the local people will be severely impacted.

Non-technical overview of results

The Amazonian forests of Loreto, Peru are situated in the western Amazon basin and harbour some of the greatest mammalian, avian, floral and fish diversity on Earth. These forests are one of the last remaining true wilderness areas left on the planet. However, these vast expanses of pristine forest will only remain intact if conservation programs are successfully implemented. Wildlife conservation in Loreto must incorporate landscape features (in terms of major habitat types of both flooded and upland forests); the biology of landscape species and the socio-economics of the rural people.

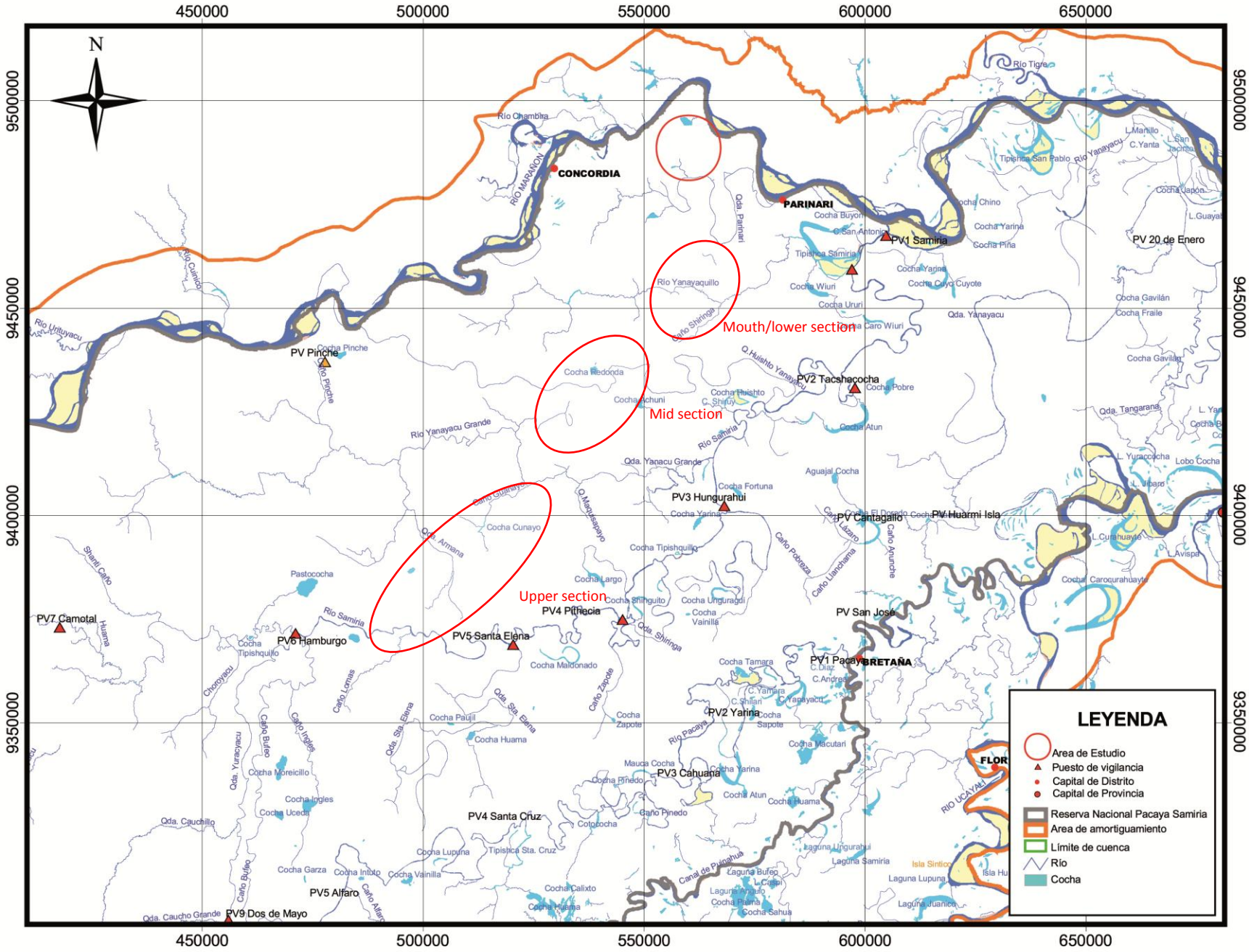
Research and conservation activities should use an interdisciplinary approach to find a balance between the needs of the indigenous people and the conservation of the animals and plants. For example, some animals like the primates, jaguars, manatees and tapirs are very vulnerable to hunting and their populations can rapidly be depleted by overhunting. Other

animals are more appropriate as a source of meat for local people, such as peccaries, deer and large rodents. This project is helping to conserve wildlife, not only for saving the biodiversity of the Amazon, but also as a means of helping the poor indigenous people who rely on these resources for their food and shelter. The project is working together with the local people, because they are the true guardians of the forest, and information provided by this research can help the indigenous people make appropriate decisions on how best to save the Amazon. The Amazon has been abused in the past, through deforestation for timber, overhunting of animals and overfishing. Local people are taking actions in places like the Pacaya-Samiria Reserve, which is an example of how things are changing; it is an example of how conservation can work in collaboration with local people, governments and NGO's.

Six years ago Dr Richard Bodmer of the Durrell Institute of Conservation and Ecology (DICE) at the University of Kent and Pablo Puertas of the Wildlife Conservation Society began to notice that the seasonal changes in the Amazon were becoming greater, after spending 25 years researching the wildlife, people and ecology of these forests. The project has been studying the river dolphins, monkeys, fish, caimans, macaws, deer, peccaries, tapirs, jaguars, giant river otters, and other species to understand how the ever increasing climatic changes are impacting their ecology, behaviour and populations. The research team is also working with the local Indian communities to see how the changes are affecting their fishing and bush meat hunting that they depend on for their daily livelihood.

The research is being conducted in the Pacaya Samiria National Reserve in the Peruvian Amazon that spans over 20,000 km^2 of seasonally flooded forests, an area the size of Wales (Map1). The wildlife of the Samiria River lives in an ecosystem that is driven by the large seasonal fluctuations occurring between high and low water seasons. The ecology of the aquatic and terrestrial wildlife revolves around these seasonal changes in water level.
The ecological conditions of long periods of flooding, up to six months, are very harsh on much of the floral and faunal community. Many plant species cannot withstand the long periods of inundation and the diversity of plants in the heavily flooded areas is lower than non-flooded areas. Likewise, the terrestrial wildlife (deer, peccaries, rodents and tapir) must seek out floodplain islands or levees during the high water season, which leads to increased competition and higher predation pressures. Even the arboreal wildlife is impacted by the flooding, since many of the fruit trees are quite seasonal in the flooded forests, resulting in seasons with low food production.

The aquatic wildlife is equally affected by the large seasonal inundations. During the flooded periods the fish enter the water laden forests and feed on the abundance of vegetative and animal production, especially the abundance of fruits, invertebrates and other living organisms trapped in the annual floods. Indeed, many tree species fruit during this season and rely on the fish as their primary means of seed dispersal. During the flooded period many fish populations reproduce within the inundated forests. Other aquatic wildlife have a more difficult time during the floods, such as the dolphins, giant river otter and other fish predators, since their prey is more sparsely distributed throughout the large expanses of the flooded forests. When the waters recede during the dry months, fish populations become condensed in the reduced lakes, rivers and channels with ever increasing competition and predation. During this period many fish populations migrate out of the smaller rivers and into the larger rivers. The dolphins and other fish predators have an abundance of prey during the low water season and even follow the fish migrations down the rivers and channels.



Map 1. Map of the Samiria River showing the sampling zones.

The people who live in the flooded forests also have adapted to the seasonal changes in both the use of the natural resources and their agriculture. During the high water season fishing is more difficult, since the fish are dispersed throughout the inundated forests. However, during this period hunting becomes easier with the large bush meat species, such as deer, peccaries and tapir being trapped on the levees and islands. In contrast, during the low water season the bush meat species become difficult to hunt as they range throughout the entire forests, and the fish become easy prey being trapped in the reduced water bodies of the lakes, channels and rivers. The local indigenous people of the floodplain forests alter their hunting and fishing accordingly, with a greater emphasis on hunting during the high water season and a greater focus on fishing during the low water season.

The project is using a set of key wildlife species to evaluate the conservation status and impact of climate change of the Samiria River basin in the Pacaya-Samiria National Reserve.

1) Ungulates are important bush meat species and were used to examine the impact on the terrestrial mammals.
2) River dolphins were used as indicator species for the aquatic systems by incorporating long-term monitoring of the dolphin populations.
3) Macaws were used as general indicators of the terrestrial systems by evaluating changes in species numbers and composition.
4) Primate populations were monitored to determine the impact on arboreal mammals and to study ecological interactions between arboreal and terrestrial wildlife assemblages.
5) Game bird populations were monitored to determine their conservation status.
6) Caiman populations were monitored to evaluate the impact on black and common caiman populations and the ecological interactions between species.
7) River turtle populations were monitored to determine the success of the conservation programme in the Samiria River basin
8) Giant river otter populations were monitored to evaluate the recovery of this rare species.
9) Amazon manatee populations were monitored in the Samiria River to evaluate the conservation status of this vulnerable species.
10) The abundance, diversity and age structure of the large fish species were monitored to determine the impact of climate change on the fisheries and the consequences for fisheries management.

River dolphins

The pink river dolphin (*Inia geoffrensis*) and the grey river dolphin (*Sotalia fluviatilis*) were used as indicator species for the aquatic ecosystem. These species are appropriate as indicator species because 1) they are top predators of the ecosystem, 2) they are not intentionally killed by people due to strong taboos, 3) they can move in and out of river systems over short periods of time, and 4) they are easy to count and observe. The dolphin's ability to move widely means that changes in dolphin populations within a river system will be caused more by dolphins leaving an area or immigrating into an area rather than a result of mortality or reproduction. Thus, if an aquatic ecosystem is going through negative changes, such as pollution or overfishing, changes in dolphin numbers in the system will be observed easily. Likewise, if a river system becomes healthier than surrounding hydroscopes dolphin numbers would increase from dolphins moving into the area.

The pink and grey river dolphins are an important part of the aquatic ecosystem in the Samiria River. The researchers are using these species as general indicators of the aquatic system. The local Cocama Indians have very strong taboos against killing dolphins and they have great respect, especially for the majestic pink river dolphin. The historic low water levels are having a negative impact on the aquatic system of the Amazon if one uses the dolphins as indicators.

The extremely low water conditions of 2010 resulted in lower dolphin numbers throughout the Samiria River. Overall, the pink river dolphin numbers have decreased by 47% and the grey

river dolphin by 49%. The dolphins have had to leave their habitats in the Samiria River and find refuge in the larger channels of the Amazon.

Macaws

Macaws were used as general indicators of the terrestrial forests. These species are appropriate as indicator species because 1) they are frugivores that rely on forest fruits, 2) they are not killed by people, 3) they can move in and out of the forest areas over short periods of time, and 4) they are easy to count and observe.

The low water appears to have impacted the smaller macaw species, especially the chestnut-fronted macaw. Prior to the low water event this species was similar in abundance to previous years (5.15 ind/point compared to 5.8 ind/point). However, after the extreme low water the chestnut-fronted macaw numbers decreased by an average of 66%. The larger blue and yellow macaw did not show this same trend and has similar numbers to previous years.

Primates and terrestrial mammal populations

Terrestrial mammals were surveyed in the Samiria River to evaluate the impact of flooding and drought in relation to the greater seasonal variations. They are also being monitored to evaluate the effectiveness of the community based wildlife management programmes. Overall, there were no obvious impacts of the low water levels on the terrestrial mammals. Primates had similar densities to annual averages. However, last year during the extreme flooding the deer, peccaries, rodents and tapirs were negatively impacted. They were forced to find small levees or floodplain islands to take refuge from the extensive floods. Their numbers decreased last year due to the opposite conditions from this year. The low water conditions of 2010 may actually allow their numbers to increase as they have much greater areas to find food as the flooded forest were dry.

In the frequently hunted zone, small bodied primates continued to dominate the mammal community with squirrel monkey, coati, brown capuchin monkey, tamarins, howler monkeys and white capuchin monkeys being the most common species. In the occasionally hunted zone, a mixture of small and large bodied primates was dominant with squirrel monkeys, brown capuchin monkeys, tamarins, howler monkeys, Amazon squirrels and white capuchin monkeys being the most common species. In the infrequently hunted zone the ungulates and large bodied primates were dominant with tamarins, howler monkeys, brown capuchin monkeys, Amazon squirrels, woolly monkeys and white-lipped peccary.
The densities of woolly monkeys (*Lagothrix poeppigii*) have remained relatively constant between 2006 and 2010. The multi-year fluctuations between 2006 and 2010 continue to show the infrequently and occasionally hunted zones to have similar densities of woolly monkeys. Surprisingly, the commonly hunted zone continues to see a significant increase in woolly monkey density in 2010.

The howler monkey (*Alouatta seniculus*) densities continue to be relatively constant in the Samiria River basin with the density of howler monkey greatest in the infrequently hunted zone, followed by the occasionally hunted zone and least in the commonly hunted zone.
The brown capuchin monkey (*Cebus apella*) densities were relatively constant in the Samiria River basin in 2010 with the greatest numbers in the occasionally hunted zone, followed by the infrequently hunted zone and least in the commonly hunted zone. The monk saki monkey (*Pithecia monachus*) densities were relatively constant in the Samiria River basin in 2010 with the greatest density in the zone with heaviest subsistence hunting.
The squirrel monkey (*Saimiri boliviensis*) densities were relatively constant in the Samiria River basin in 2010 with the greatest numbers in the occasionally hunted zone, followed by the infrequently hunted zone and least in the commonly hunted zone. The saddled back tamarin (*Saguinus fuscicollis*) densities were relatively constant in the Samiria River basin in 2010 and

were similar between the occasionally hunted zone and infrequently hunted zone and least in the commonly hunted zone. The white-fronted capuchin monkey (*Cebus albifrons*) densities were relatively constant in the Samiria River basin in 2010.

The intensive flooding in 2009 impacted the terrestrial wildlife species. The 2010 data showed decreases in the populations of white-lipped and collared peccary (*Tayassu pecari* and *Pecari tajacu*), which correlates to the previous year's flooding. Peccaries become trapped on floodplain islands during the high water and the extreme flooding in 2009 apparently resulted in greater mortality, which was reflected in the 2010 population numbers.
The white-lipped and collared peccary densities have been relatively constant in the Samiria River basin between 2006 and 2009. The commonly hunted zone has always had very low populations of peccary. The red brocket deer (*Mazama americana*) densities were relatively constant in the Samiria River basin in 2010. The commonly hunted zone has always had very low populations of red brocket deer. The lowland tapir (*Tapirus terrestris*) densities continued to have an increasing population trend in the Samiria River basin in 2010. The commonly hunted zone has always had very low populations of lowland tapir. The coati (*Nasua nasua*) densities had a relatively stable population in 2010 after the significant increases in their population in 2009. Over the past few years the greatest increases in coati populations have been in the commonly hunted (and infrequently hunted zones), with more stable populations in the occasionally hunted zone. The black agouti (*Dasyprocta fuliginosa*) densities continue to be relatively constant in the Samiria River basin with greatest numbers in the infrequently hunted zone, followed by the occasionally hunted zone and least in the commonly hunted zone. The tamandua (*Tamandua tetradactyla*), tyra (*Eira barbara*), three toed sloth (*Bradypus variegatus*) and Amazon squirrel (*Sciurus spadiceus/igniventris*) densities were relatively constant in the Samiria River basin in 2010.

Game bird populations

The overall number of game birds was greatest in the infrequently hunted zone, followed by the occasionally hunted zone and least in the commonly hunted zone. The density of game birds continues to increase the most in the occasionally hunted zone.
The overall increase in the density of tinamous (*Tinamidae*) in the Samiria River over the years has stabilized in 2010, with similar numbers to 2009. The razor-billed curassow (*Mitu tuberosum*) is generally a rare species in the Amazon and has overall low numbers in the Samiria. The densities in 2010 were similar to those of 2009. There were no sightings of this species in the commonly hunted zone.
The Spix's guan (*Penelope jacquacu*) population was relatively stable in 2010 and as were the population of blue-throated piping guan (*Aburria cumanensis*).

The abundance and age structure of fish

The fish were impacted by the extremely low water levels of the Samiria River. In June, prior to the receding waters the fish had a greater abundance than average in the Samiria (10 individuals per hour (ind/hr) compared to 5.3 ind/hour)). However, as the waters receded the abundance of fish started to decline and in July fish numbers were below average (10.61 ind/hour compared to 11.3 ind/hour). As the season progressed and the water levels sank below the long term levels the fish abundance became obviously lower than average with a 63% decrease from normal years (4.5 ind/km compared to12.2 ind/hour).

As in previous years, differences were seen in the fish composition between the low water and high water seasons in the Samiria River basin in both the mid section and upper Samiria. The abundances between the two seasons showed that dominant fish species differed, reflecting a change in the community structure of the fish populations. During the low water season the two dominant species in the Samiria were *Liposarcus pardalis* (catfish family) and gold wolf fish

(*Hoplerythrinus unitaeniatus)* whilst during the high water season the dominant species were black piranha (*Serrasalmus rhombeus*) and red-bellied piranha (*Pygocentrus nattereri*).

Caiman

Demography (size structure) was used to evaluate the general health of the populations. The general trend is towards increasing size structure and healthier populations in the Samiria. Caiman populations were monitored to evaluate the recovery of black caiman populations and the ecological interactions between species.

Three species of caimans occur in the Pacaya-Samiria National Reserve, the black caiman (*Caiman niger*), the common/spectacled caiman (*Caiman crocodilus*) and the dwarf caiman (*Paleosuchus trigonatus*). The black caiman was intensively overhunted during the 1950's - 1970's and has been recovering in the Samiria River over the past decades. The abundance of caiman varies along the Samiria River. The abundance of common caiman and black caiman were both greatest in the upper section of the river, followed by the mid section and least in the lower section. The caimans are resident species and do not have migratory movements as the dolphins or fish do. The common/spectacled caiman was impacted by the extreme low water levels, whereas the black caiman did not appear to be affected. The common/spectacled caiman has an overall lower abundance in the Samiria River than their six year average with the upper section having 56% fewer, the mid section having 27% fewer, and the lower section having 40% fewer. The black caiman abundances were more similar and did not show general declines, with the upriver section having very similar numbers to previous years, the mid section having slightly fewer and the lower section having greater numbers than previous years.

Turtles

River turtle populations were monitored to determine the success of the conservation programme in the Samiria River basin. The Pacaya-Samiria National Reserve has implemented a turtle conservation program based on head starting for a number of years, where eggs of yellow-spotted Amazon river turtle (*Podocnemis unifilis*) and giant Amazonian river turtle (*Podocnemis expansa*) have been removed from their wild nests, replanted at guard stations, hatched, and released back into the river. This conservation strategy has been set up to overcome the intensive poaching of turtle eggs during the laying season. River turtle numbers are recovering along the Samiria river basin as a result of the head starting program.

The abundance of yellow-spotted Amazon River turtle was determined by turtles sunning along the riverbanks, whereas giant Amazonian river turtle do not sun along the banks therefore only turtles in the water can be counted. The density of turtles was determined during aquatic transects. Data collected on optimum days was used to calculate maximum densities, which included hot temperatures and sunny conditions. Data from all days, which included all weather conditions, were used to calculate average density. The population density of yellow spotted river turtle continued to increase in 2010.

Otters and Manatee

Giant river otter (*Pteronura brasiliensis*) and manatee (*Trichechus inunguis*) populations were monitored to evaluate the recovery of these rare species. The giant otter is endemic to South America and has shown a marked decline due to excessive pelt hunting during the 1940's to 1970's with many populations becoming extirpated. By the end of the 1970s, the giant otter was nearly extinct. Studies of giant otter are a high priority for the IUCN and long-term conservation efforts for this critically endangered flagship species are needed. Today, the giant otter is beginning to show a slow recovery in population size in many areas of its former range

in the Amazon, including the Samiria River basin. The sightings of giant river otter have increased substantially in the Samiria River basin over the years.

The giant river otter population increased significantly in 2010 along the lower, middle and upper sections of the Samiria River. Sightings are becoming more common, but are still infrequent.

The manatee population along the Samiria River has been relatively stable during 2010. This species is still occasionally hunted by local people, often killed when mistaken for Piache fish. The Samiria River basin continues to be a stronghold for the species in Loreto, but further conservation efforts are required.

Birds

Wading bird populations were monitored to determine annual migrations. The mouth of the Samiria River shows a dramatic seasonal fluctuation in the wading bird abundance, dominated by great egret (*Ardea alba*) and the neotropic cormorant (*Phalacrocorax brasilianus*). During the fish migrations out of the Samiria River during the dry season these two species aggregate at the mouth of the Samiria between the months of September and November. The peak numbers of egret and cormorant were in the month of September. Other species that showed high numbers in September were the wattled jacana (*Jacana jacana*), cocoi heron (*Ardea cocoi*) and snowy egret (*Egretta thula*).

The extreme drought of 2010 resulted in lower numbers than previous years, presumably because the wading birds congregated along the larger rivers following the exit of fish out of the Samiria River.

Cocama indigenous people

The local Cocama Indians needed to adjust their livelihoods to the drought conditions in 2010. Usually, during the low water season people rely on fishing for their subsistence food and income. However, the Samiria River became so low that most of the fish either died or left and the local people needed to adjust their activities. Fish populations were large enough to support the people's subsistence demands but did not permit the usual financial returns. Fortunately, there are still enough wildlife resources in the Samiria because of the conservation actions taken by the local people over the past decade. However, if the extreme climatic events continue both the wildlife and the local people will be impacted.

SECTION TWO

REPORTING AGAINST RESEARCH OBJECTIVES

Results and progress against objectives

Sample Sizes of Censuses

The data collected during censuses in 2010 was greater than previous years and is displayed in Table 1.

Table 1. Sample size of censuses between 2006 and 2010.

Census	Samiria				
	2006	**2007**	**2008**	**2009**	**2010**
Terrestrial mammals & game birds (km)	540	820.87	1068.65	1171.7	1826.96
Dolphins (km)	217	259.47	442.15	950.1	1318.66
Caimans (km)	189.23	124.62	252.8	742.82	1109.197
Macaws (points)	331	622	383	1046	1753
Fish (hours)	307	175.3	135.45	290.31	508.98
River turtles (km)	101.95	24.95	193.69	249.29	
Wading birds (km)	24.72	15	180.50	404.68	281.58
Understory birds (hours/net)					1934.62
frogs (hours/man)					384.93

Objective 1: Dolphins

In 2010 the overall abundance of pink river dolphin was 3.02 per km and was greater than the abundance of grey river dolphin at 1.49 per km respectively (Figure 1). The abundance of prink river dolphins differs along the course of the Samiria River,with the mouth section having greater numbers than the mid sections of Tacshacocha and Wishto, but with similar abundances to the upriver area of Ungurahui. In contrast, grey river dolphins showed no differences in abundance along the course of the Samiria River.The age structure of pink and grey river dolphins had greater proportions of adults than juveniles and young, respectively.

Pink river dolphins had a greater proportion of juveniles and young in the Ungurahui area, since the lake of Ungurahui is used as a nursery. This is an important result, since it shows that pink river dolphins use certain lakes to raise their young in some form of social unit. We also observed this at the Lago Preto site. It appears that they congregate at certain lakes with

their young in order to teach their offspring fishing techniques within larger social units. This is a type of school nursery.

Pink river dolphins had group sizes up to 5 individuals, with solitary individuals and pairs being the most frequent. Only in the low water season were groups of greater than 5 individuals observed in the mouth region. Grey river dolphins had slightly larger group sizes, however solitary individuals and pairs are common.

The extreme low water conditions of 2010 resulted in lower dolphin numbers throughout the Samiria River. Overall, during the drought the pink river dolphin numbers decreased by 47% and the grey river dolphin by 49%. The dolphins left their habitats in the Samiria River and found refuge in the larger channels of the Amazon.

The six year average for pink river dolphins at the mouth of the Samiria River has been 6 ind/km, however this year during the drought the abundance was only 4.7 ind/km. Likewise the six year average for the grey river dolphin at the mouth has been 1.5 ind/km compared to 0.8 ind/km for this year during the drought. The Taschacocha site, situated in the lower mid section has had a six year annual mean of pink river dolphins of 3.1 ind/km compared to this year of 0.9 ind/km. Likewise, the grey river dolphin has had an annual mean of 1.6 ind/km at the Taschacocha site compared to only 0.7 ind/km for this year. The upriver site of Hungurahui has lower numbers of pink river dolphins (1.7 ind/km) than the annual average of 3.5 ind/km. The grey river dolphin had lower than average numbers at both the mid (0.7 ind/km compared to 2.4 ind/km) and upriver sections (1.5 ind/km compared to 2.1 ind/km).

The decreases in dolphins numbers is directly related to the fish populations. As the season progressed and the water levels sank below the long term levels the fish abundance became obviously lower than average with a 63% decrease from normal years.

The fish species of *Liposarcus pardalis* (armoured catfish family), black Prochilodus (*Prochilodus nigricans*), *Heros appendiculatus* (*Chiclidae* family), black-finned Pacu fish (*Colossoma macropomum*), *Astronotus ocellatus* and red-bellied piranha have a greater abundance in the preferred habitats of pink river dolphins in the Samiria River. In contrast, the fish species of black piranha and *Leporinus* species are more abundant in the preferred habitats of grey river dolphins. The strongest relationship between fish abundance and dolphins were between pink river dolphin and red-bellied piranha and grey river dolphin and black piranha.

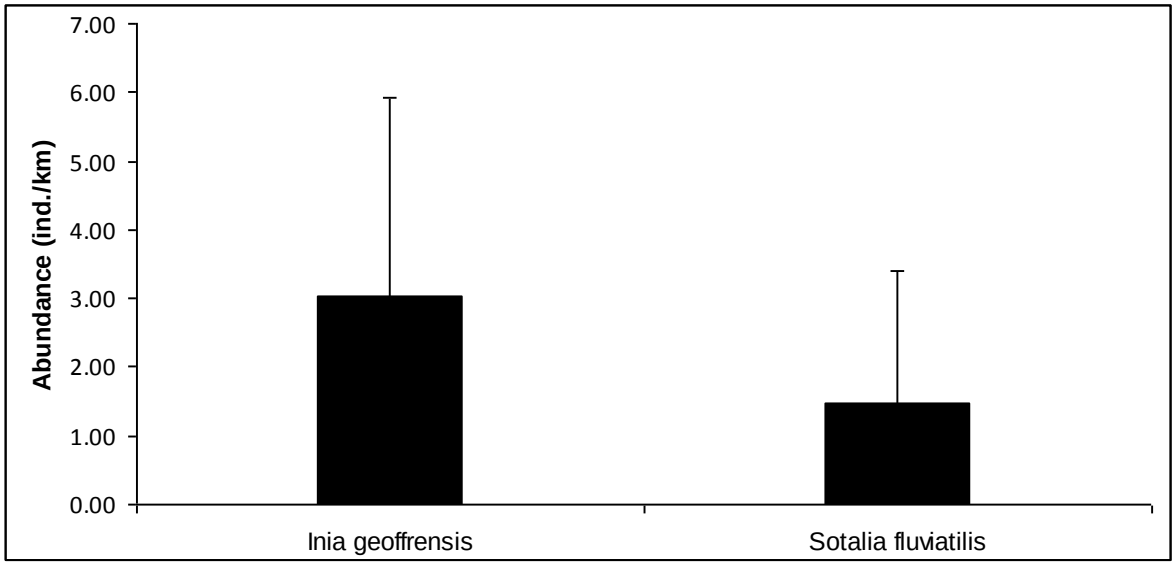


Figure 1. Abundance of dolphins in the Samiria River in 2010.

Objective 2: Macaws

In 2010 the macaw species differed in their relative abundances, with the greatest abundance being the chestnut-fronted macaw (*Ara severus*) at 3.4 individuals and the blue-and-yellow macaw (*Ara ararauna*) at 2 individuals. The less abundant species werethe red-bellied macaw (*Orthopsittaca manilata*) at 1.16 individuals and red-and-green and scarlet macaws (*Ara macao/chloroptera*) at 0.07 individuals (Figure 2).

In 2010 as in previous years the abundance of macaws differs along the course of the Samiria River. In the upriver sections blue-and-yellow macaws and chestnut-fronted macaws are more abundant with 5.0 & 3.6 individuals per point respectively. In the mid-river sections chestnut-fronted macaw were most abundant at 5.2 individuals followed by blue-and-yellow macaw with 2.5 individuals. In the mouth region, macaw abundances are generally lower with slightly greater observations of red-bellied macawand no sightings of red-and-green or scarlet macaws.

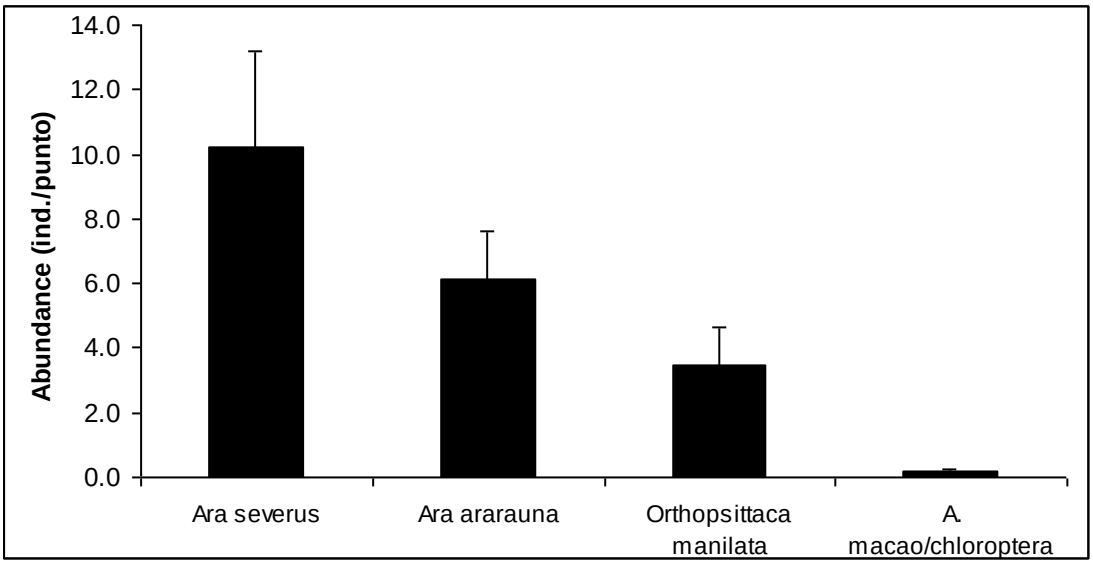


Figure 2. Abundance of macaw populations in the Samiria River in 2010

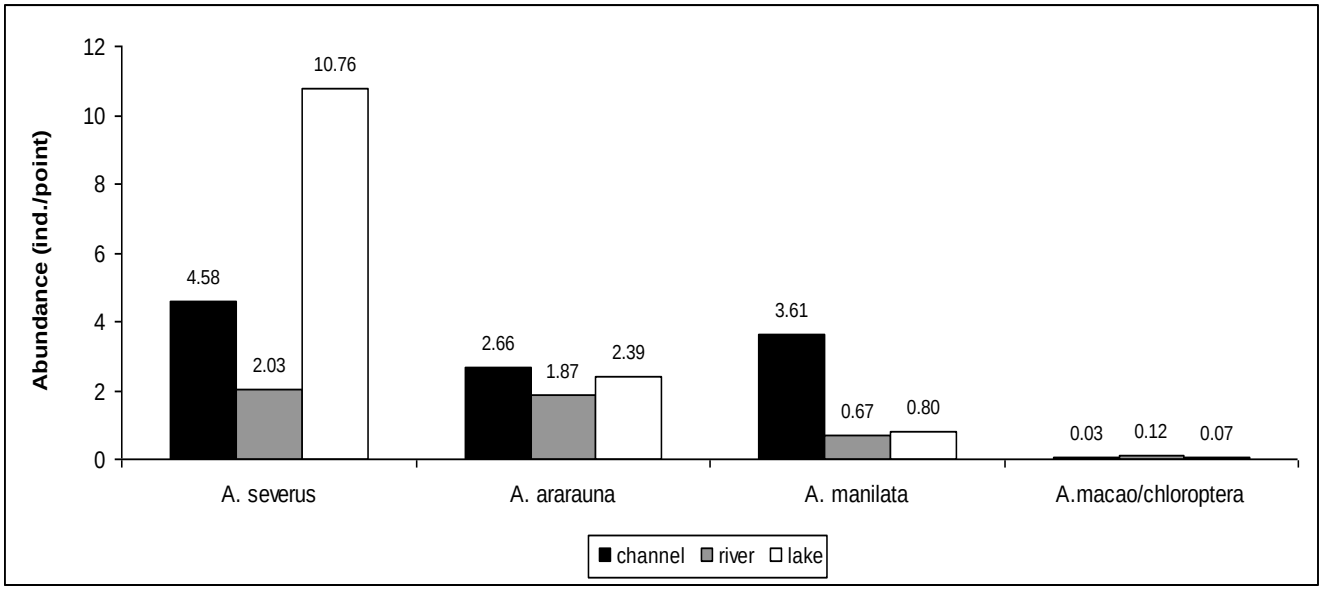


Figure 3. Abundance of macaws in different habitats in the Samiria River in 2010.

Overall, there are greater abundances of macaws in the lakes and channels than along the main river. Chestnut-fronted macaws had a greater abundance in lake habitats, Blue-and-yellow macaws had a similar abundance in the lakes and channels. Red-bellied macaws had a greater abundance in the channels and blue-and-green macaws were present in channels and lakes and absent in the rivers. Scarlet macaws were only observed along the river (Figure 3).

Seasonal changes were observed in the macaw abundances. Overall, macaws were more abundant in the dry season. The blue-and-yellow macaw was more abundant in the dry season, Blue-and-green and scarlet macaws were more abundant in the wet season, and chestnut-fronted macaws had a greater abundance in the high water season in the upper reaches and a greater abundance in the low water season in the lower reaches of the Samiria. Red-bellied macaws had a greater abundance in the dry season.

Positive Lotka Volterra relationships were observed between the macaw species and primates. Areas with greater macaw abundance also had greater primate abundances. The macaws are used as indicator species, and the positive relationship between the primates and macaws supports the macaws as indicator species for the terrestrial habitats (Figure 4).

Objective 3: Wading Birds

The abundance of wading birds was lower in 2010 than in 2009. This correlates with the drought conditions of 2010. The wading birds rely on the abundant fish production of the Samiria River during the low water season. Fish populations emigrated out of the Samiria during the intensive drought period. The wading birds followed the fish migration and departed the Samiria during this period, resulting in lower overall densities (Figure 5).

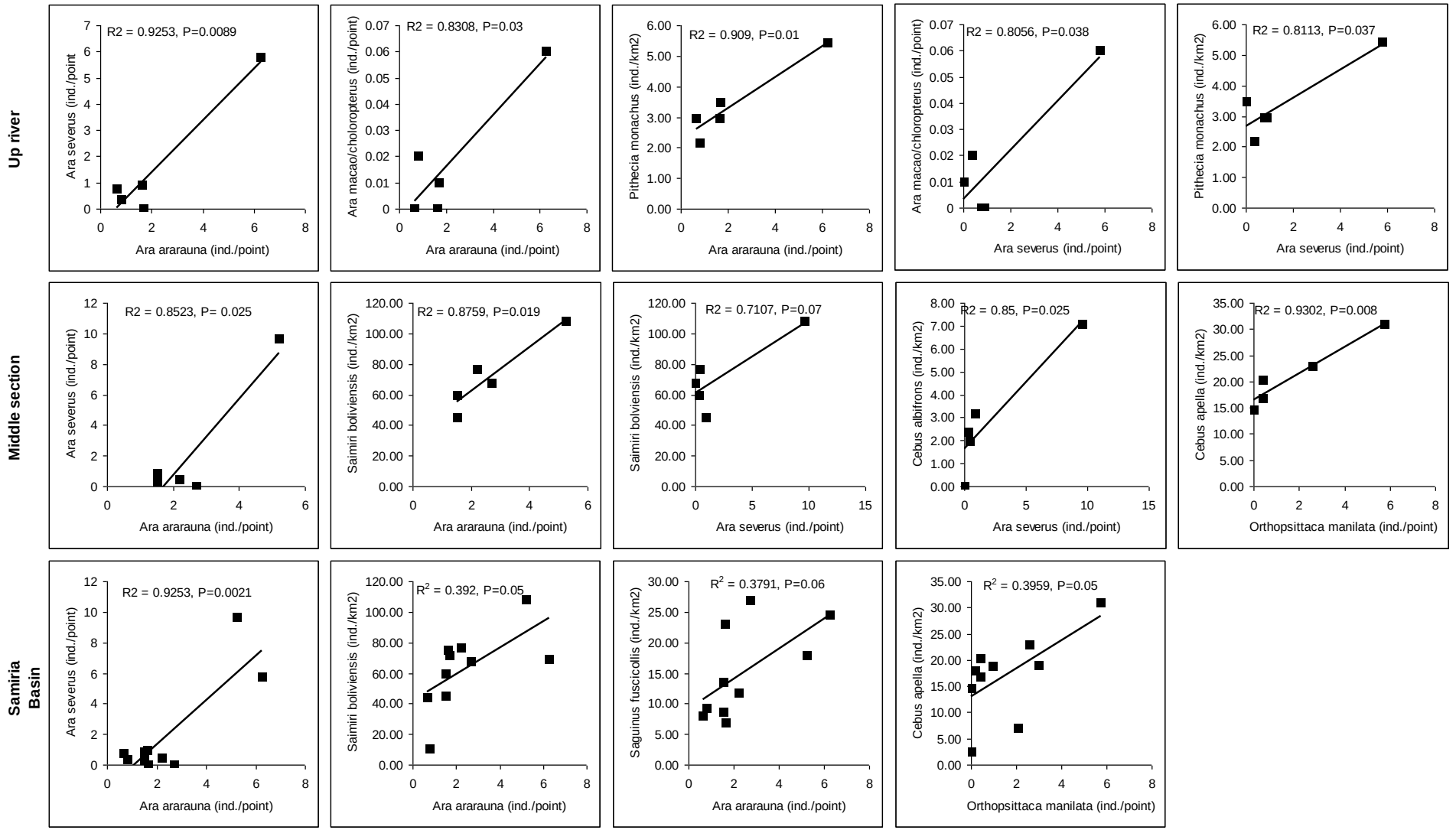
The wading birds that were most common at the mouth included neotropic cormorant and great egret, which form very large flocks. Other important species at the mouth include wattled jacana, snowy egret, cocoi heron and the horned screamer (*Anhima cornuta*).
The most common wading birds at the mid section of the Samiria include great egret and neotropic cormorant. Other important species include cocoi heron, snowy egret, little or striated heron (*Butorides striatus*) and wattled jacana.

The most common wading birds in the upper section of the Samiria River include wattled jacana and cocoi heron. Other important species include capped heron (*Pilherodius pileatus*), little heron, cocoi heron and neotropic cormorant.

The seasonal variation of wading birds can be categorised in four groups: Group one (great egret, cocoi heron, snowy egret and neotropic cormorant) is very seasonal with large numbers during the low water season and very low numbers during high water. Group two (wattled jacana, horned screamer and and ringed kingfisher - *Megaceryle torquata*) has a relatively constant abundance through the year and does not show much seasonal variation. Groups three (yellow billed tern - *Sterna supercilliaris*) and four (large-billed tern - *Phaetusa simplex*) are very seasonal, but at different times of the year, and not have not corresponded clearly to the seasonal changes in water levels.

There are clear correlations between the wading birds and certain fish species. For example there were positive correlations between neotropic cormorant and Liposarcus pardalis “carachama” (catfish), and cormorant and black Prochilodus.

Figure 4. Lotka-Volterra correlations in the Samiria River between primates and macaws.



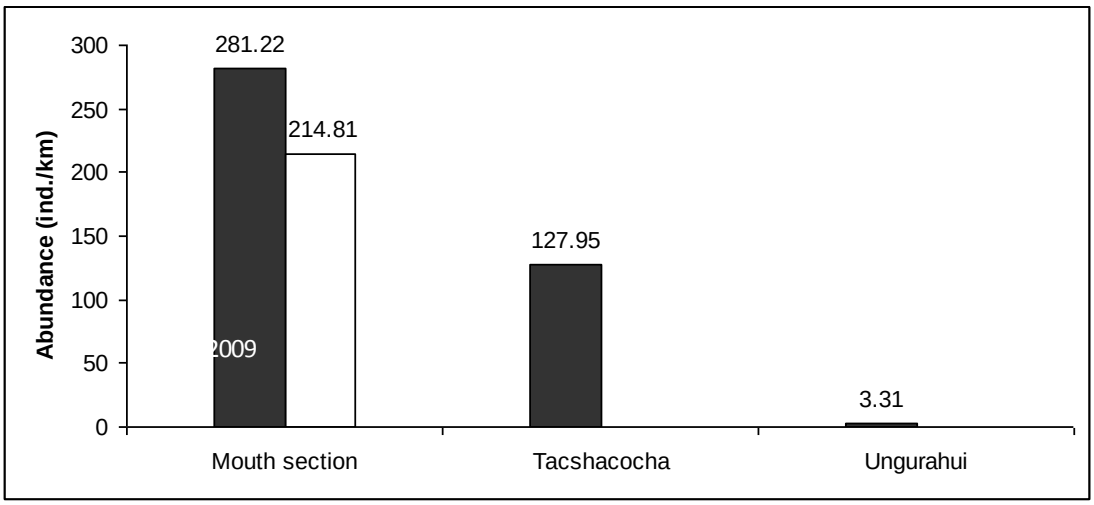


Figure 5. Abundance of wading birds along the Samiria River in 2010.

Objective 4: Understory Birds

In 2010 we conducted an evaluation of understory birds in coordination with the Wildlife Conservation Society (WCS). 87 species of birds were recorded in Tacshacocha and Wishto. 63 species were registered in the low lying more flooded habitats that dominate the Samiria, and 59 species were registered in the levee habitats. There was a greater abundance of birds in the lower flooded habitats than the levee habitats using CPUE analysis (Figure 6).

There were 22 species that were registered for the first time in the Pacaya Samiria National Reserve during the survey that included the following species: white-vented plumleteer (*Chalybura buffoni*), green-crowned woodnymph (*Thalurania fannyi*), black-throated hermit (*Phaethornis atrimentalis*), Gould's jewelfront (*Heliodoxa aurescens*), violet-bellied hummingbird (*Damophila julie*), ivory-billed aracari (*Pteroglossus azara*), rufous-breasted piculet (*Picumnus rufiventris*), wedge-billed woodcreeper (*Glyphorynchus spirurus*), rufous-capped antshrike (*Thamnophilus ruficapillus*), Cocha antshrike (*Thamnophilus praecox*), dusky-throated antshrike (*Thamnomanes ardesiacus*), grey antwren (*Myrmotherula menetriesii*), Peruvian warbling antbird (*Hypocnemis peruviana*), dot-backed antbird (*Hylophylax punctulatus*), black-spotted bare eye (*Phlegopsis nigromaculata*), , olivaceous piha (*Snowornis cryptolophus*), ochraceous Attila (*Attila torridus*), alder flycatcher (*Empidonax alnorum*), sepia-capped flycatcher (*Leptopogon amaurocephalus*), fulvous shrike-tanager (*Lanio fulvus*), and black-billed seed-finch (*Oryzoborus atrirostris*).

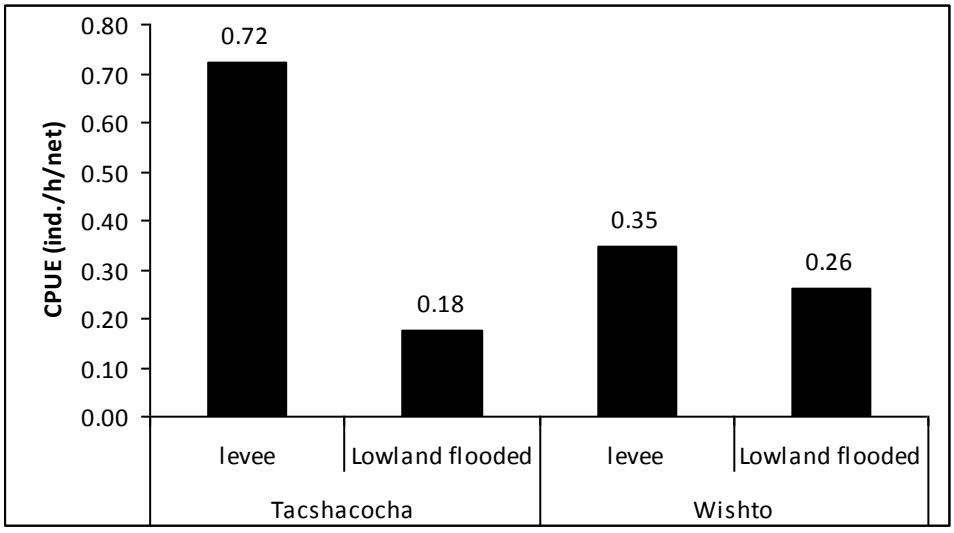


Figure 6. CPUE of understory birds in different habitat types in the two sampling

Objective 5: Frogs

A survey of the frog species was also conducted in 2010 in collaboration with the Wildlife Conservation Society (WCS) in the Samiria River basin. Frog diversity differed between the aquatic and terrestrial habitats with terrestrial habitats generally having greater diversity than the aquatic habitats. The abundance of frogs (ind./hour/man) differed between habitat types. The habitats with greatest abundances were the lakes (10.1 ind./hour/man), streams (6.2 ind./hour/man), river edge (5.3 ind./h/hombre) followed by low terrace forests with poor drainage (3.8 ind/h/hombre), and other low terrace forests (Figure 7).

Species encounter rates differed between habitats, with the highest encounter rate in lakes and streams. These habitats have both the greatest numbers of individuals and the highest rate of species.

Objective 6: Terrestrial Mammals

The population density of terrestrial mammals continues to be greatest in the lightly hunted zone, followed by the moderately hunted zone and the commonly hunted zone, with overall terrestrial mammal densities of 170.1, 158.9 and 101.8 ind./km2 respectively. This same trend is also reflected in the overall terrestrial mammalian biomass.

Primates dominated the density of terrestrial mammals with 158.9 ind./km2 in the lightly hunted zone, 145.5 ind./km2 in the moderately hunted zone and 93.5 ind./km2 in the commonly hunted zone.
The most common species in the lightly hunted zone included saddleback tamarin, capuchin monkey, red howler monkey , squirrel and white-fronted capuchin. In the moderately hunted zone the most common species were Bolivian squirrel monkey (*Saimiri boliviensis)* saddleback tamarin, capuchin monkey, red howler monkey, squirrel and woolly monkey. In the commonly hunted zone the most common species were squirrel monkey, saddleback tamarin, capuchin, red howler, monk saki and squirrel species (Figure 8).

The biomass of primates shows the same trend as the densities, and the large bodied species that are more common in the less hunted zones dominate the biomass values. In contrast, the ungulates have greater biomass in the moderately hunted zone and lower biomass in the lightly hunted and commonly hunted zones, Carnivore biomass was similar between all of the zones, and was influenced most by coati, tayra and giant otter. Rodent biomass was similar between the lightly hunted and moderately hunted zones and least in the intensively hunted zone. Overall, the biomass of edentates was low with similar values between the zones.

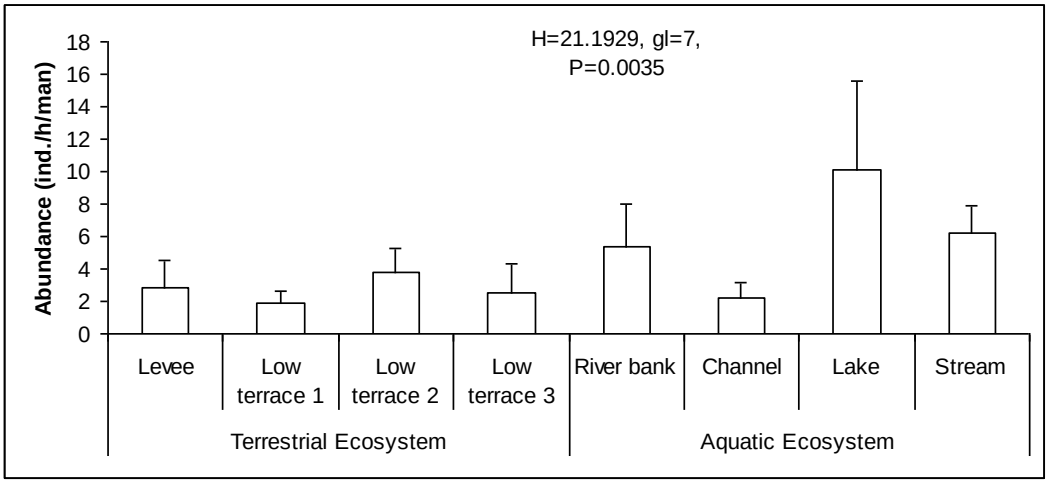


Figure 7. Abundance of frogs in different habitat types of the Samiria River.

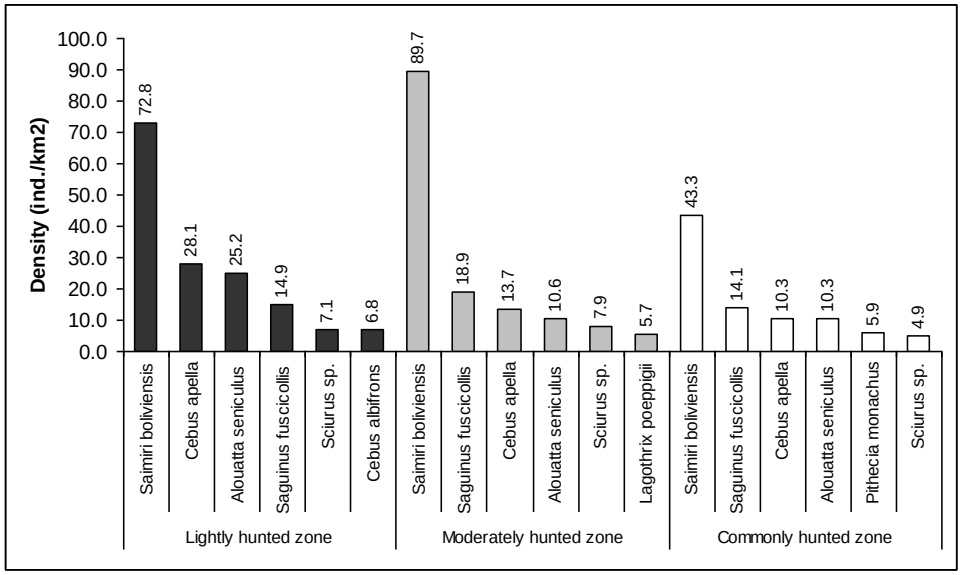


Figure 8. Species with greatest densities in the different hunting zones of the Samiria River in 2010.

In the lightly hunted zone the terrestrial mammal biomass is dominated by red howler, brown capuchin, Bolivian squirrel monkey, woolly monkey and white-lipped peccary. In the moderately hunted zone the biomass is dominated by squirrel monkey, red howler, white-lipped peccary, capuchin, woolly monkey and tapir. . In the commonly hunted zone the biomass is dominated by red howler, squirrel monkey, capuchin, woolly monkey, giant otter and tayra.

The most important population trends in the terrestrial mammals were the following in 2010: The woolly monkey continues to have a significant increasing population in the commonly hunted zone. Woolly monkeys are the most vulnerable species of primates due to overhunting and were overhunted in the commonly hunted zone in the past. The increasing population of woolly monkeys in the commonly hunted zone indicates a very positive response to local participation in community based management (Figure 9).

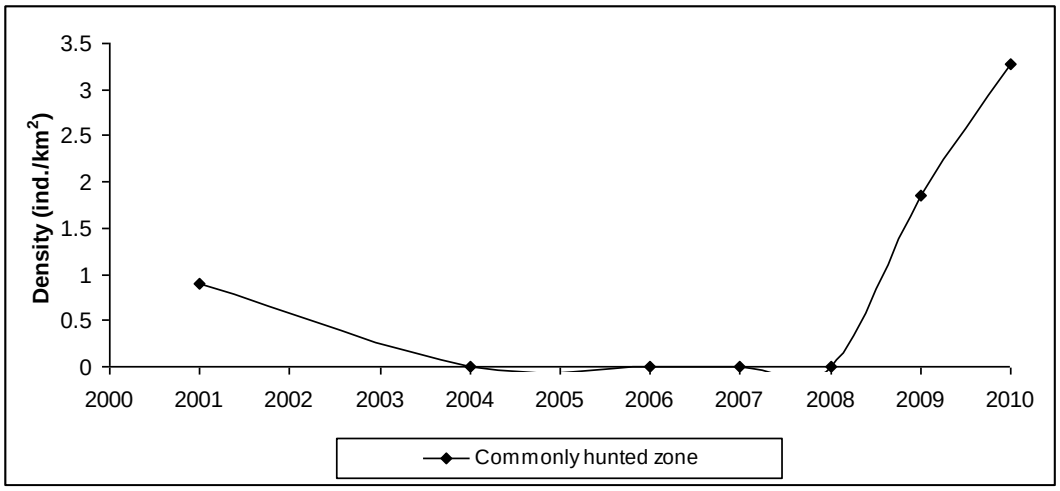


Figure 9. Population trends of woolly monkey in the commonly hunted zone of the Samiria River between 2001 and 2010.

The decreases in the population of white-lipped and collared peccary are most likely due to the impacts of the 2009 floods. These species are particularly vulnerable to intensive flooding events that result in small patches of dry ground. 2009 was the greatest flooding event in recorded history and likely resulted in extensive mortality of the peccaries, which is now reflected in the 2010 census results (Figures 10 & 11)

The lowland tapir has shown a significant increase in its population in 2010. Unlike the peccaries, the tapir can withstand more flooded conditions and does well during the high water season. The tapir is the most vulnerable ungulate to overhunting and the positive trend in its population reflects the conservation actions of the local people and their involvement in community based wildlife management.

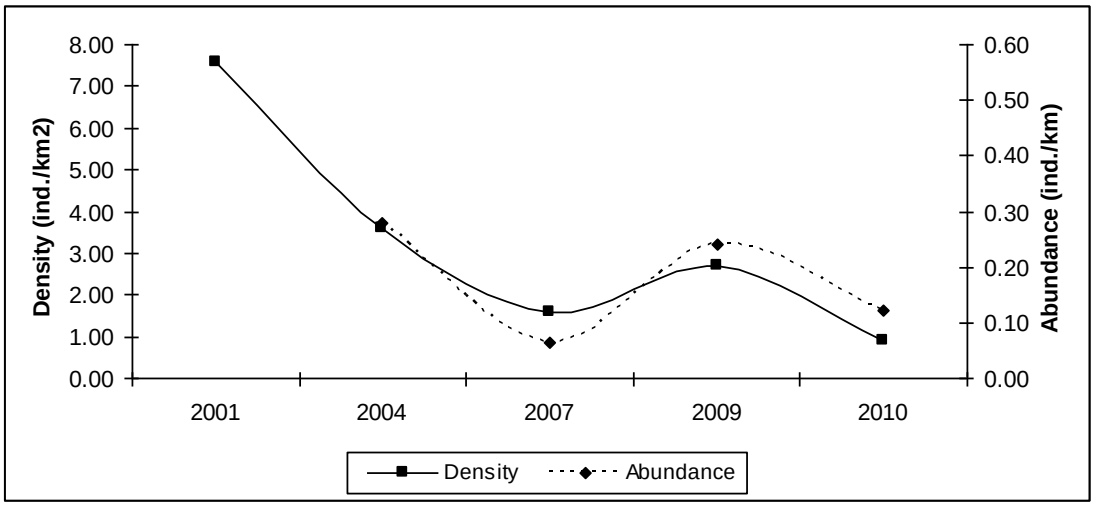


Figure 10. Population trends of *Tayassu pecari* between 2004 and 2010 in the Samiria River.

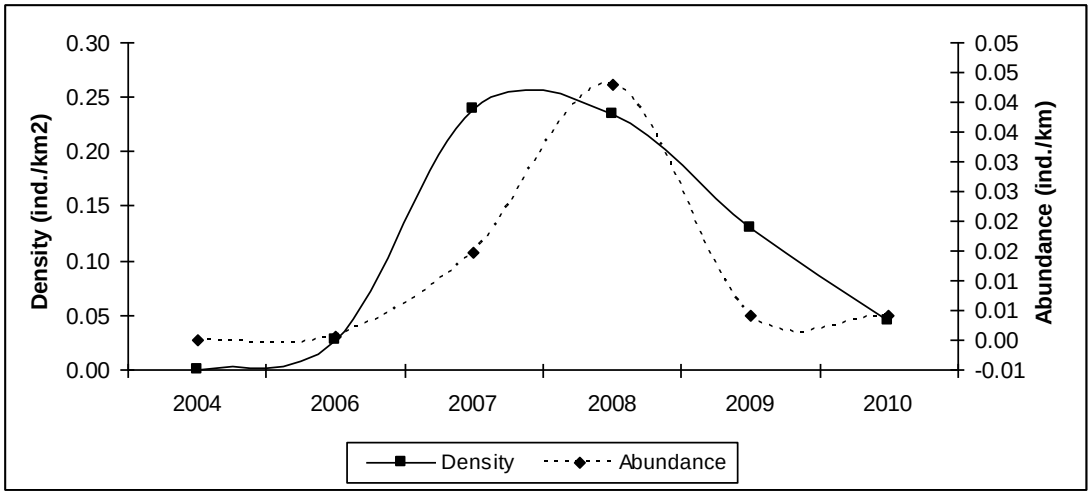


Figure 11. Population trends of *Tayassu tajacu* between 2004 and 2010 in the Samiria River.

Objective 7: Game Birds

The game bird densities were similar in 2010 compared to 2009 with overall densities of 6.8, 5 and 3 ind./km2 in the lightly, moderately and commonly hunted zones, respectively.

There was no significant difference between the three zones, reflecting a continued positive influence of the community based wildlife management. Likewise, the climatic variations of floods and drought do not appear to have had an immediate impact on the game bird populations (Figures 12 and 13).

Objective 8: Caimans

In 2010 the population of spectacled caiman in the upper Samiria River was 1.5 ind./km, in the mid section it was 0.7 ind./km and in the lower section 0.1ind./km showing a significant difference between the river sections. The density of black caiman (*Melanosuchus niger*) was 1.1ind./km in the upper Samiria, 0.5ind./km in the mid section, and 0.2ind./km in the lower section, showing a significant difference between the river sections. Dwarf caiman (*Paleosuchus trigonatus*) had a population of 0.01 ind./km in the upper section, 0.01ind./km in the mid section and 0.002ind./km in the lower section with no significant difference along the Samiria River (Figure 14).

The caimans are resident species and do not show the more migratory movements as the dolphins or fish. The spectacled caiman appears to have been impacted by the extreme low water levels, whereas the black caiman was not affected. The spectacled caiman had an overall lower abundance in the Samiria River than their six year average with the upper section having 56% fewer (upriver 5 year average: 1.4ind./km; during drought 2010 upriver numbers: 0.6ind./Km), the mid section having 27% fewer (mid section 5 year average: 0.7ind./km; during drought 2010 mid section numbers: 0.5 Ind/Km), and the lower section having 40% fewer (mouth 5 year average: 0.3 ind./km; during drought 2010 mouth numbers: 0.2Ind/Km). The black caiman abundances were more similar and did not show general declines, with the upriver section having very similar numbers to previous years, the mid section having slightly fewer and the lower section having greater numbers than previous years.

Figure 12. Density of game birds in different hunting zones of the Samiria River.

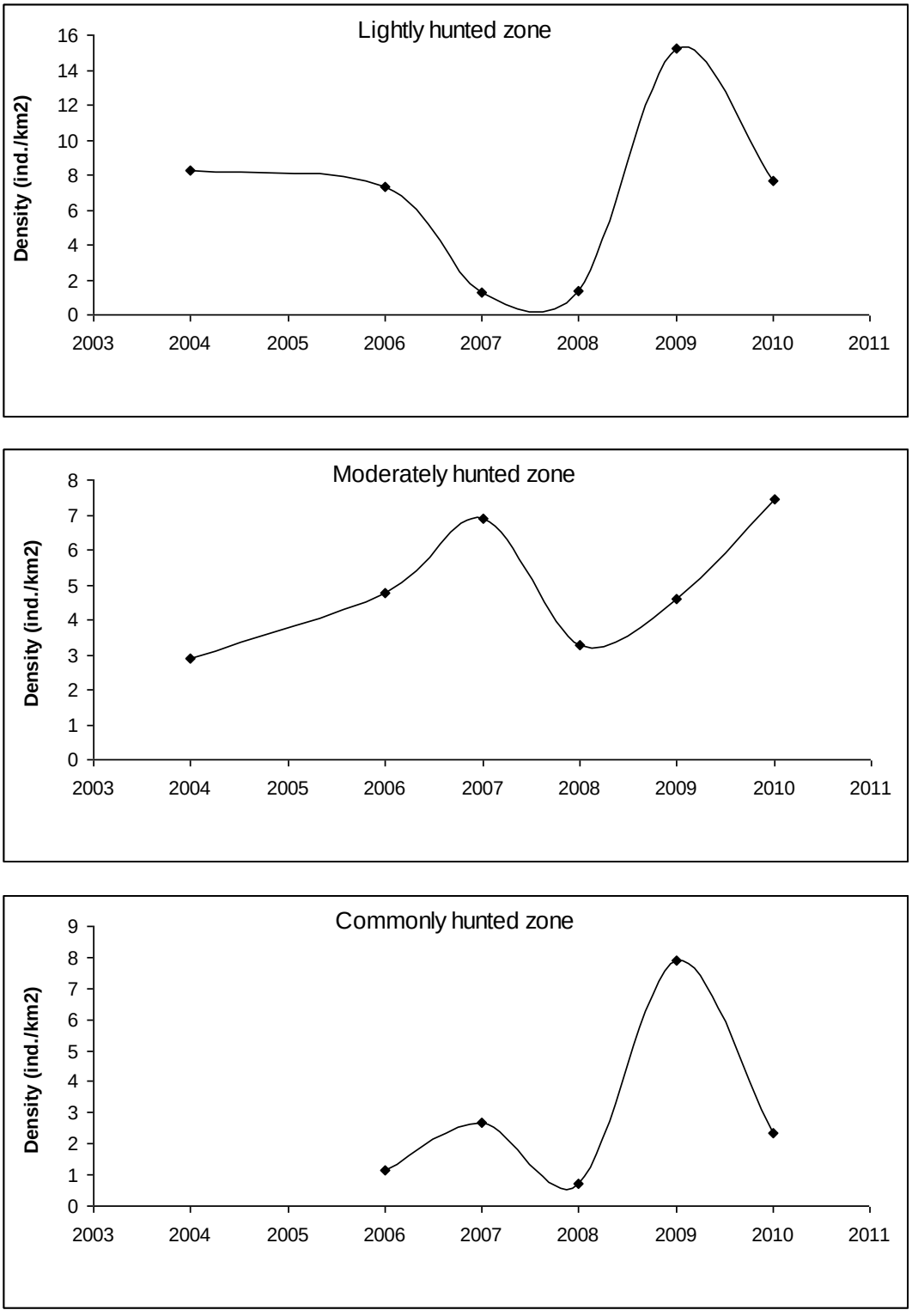


Figure 13. Population trends in game birds in different hunting zones of the Samiria River between 2004 and 2010.

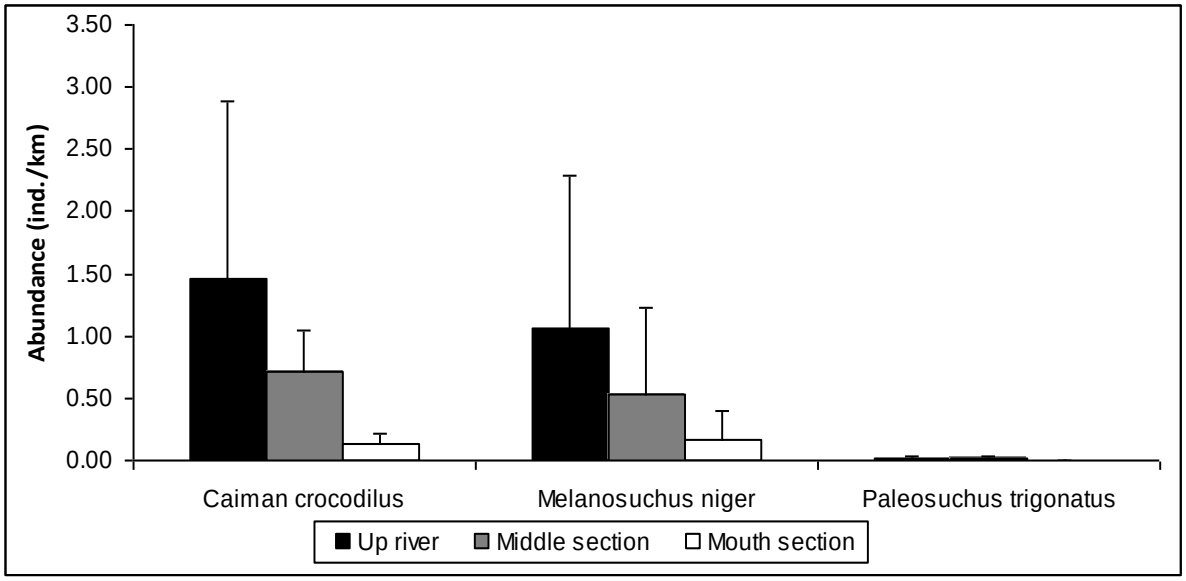


Figure 14. Population abundance of caimans along the Samiria River in 2010.

Objective 9: Giant River Otter and Manatee

In 2010, the giant river otter showed a substantial increase in population, especially in the upper Samiria River. Groups were sighted on a regular basis around the Ungurahui section, especially the lake. Sightings in the mid section and mouth section were similar to 2009. Giant river otters are still relatively rare in the Samiria, but every year there are greater numbers of sightings and the population numbers show a recovery (Figure 15). Manatee sightings were similar to 2009. They continue to be infrequent and sightings are collected during other aquatic surveys.

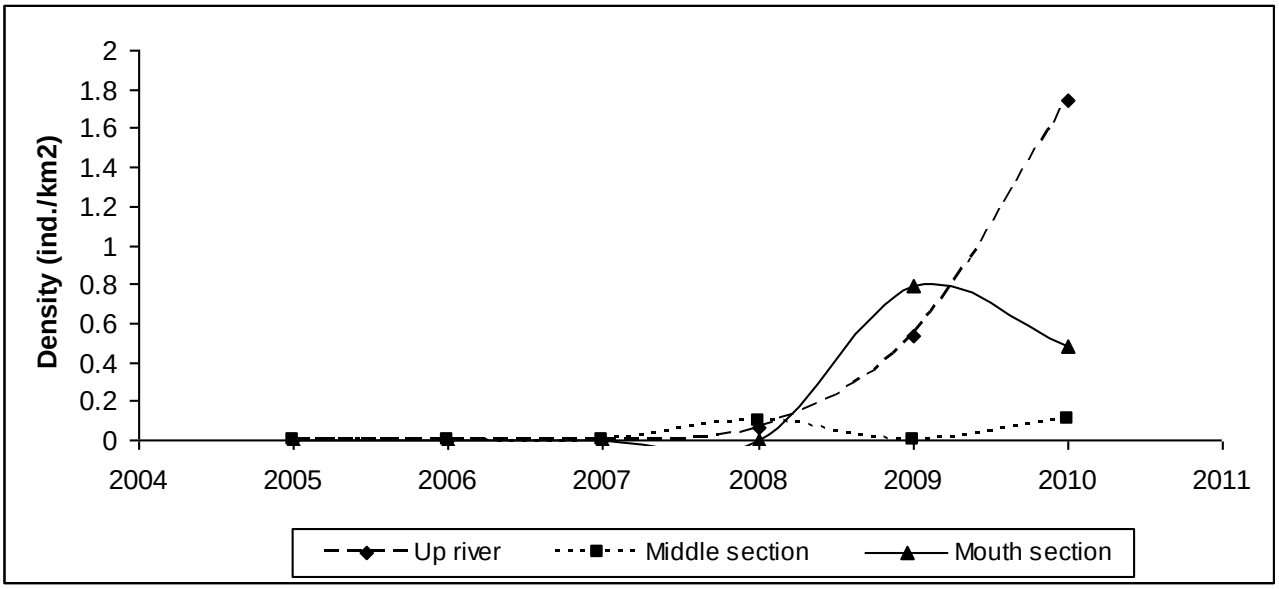


Figure 15. Population trend of giant otter in different sites along the Samiria River

Objective 10: River Turtles

The population of river turtles continues to increase as a result of the programme. We are currently conducting further analysis on this programme.

Objective 11: Fish

52 species of fish were registered during the CPUE surveys. CPUE shows that the mid section has the greatest abundance of fish with 10.6ind./hour/net, followed by the mouth section with 9.3ind./hour/net and lastly the upper section with 5.37 ind./hour/net.

Overall, *H. unitaeniatus* and *L. pardalis* were the most abundant species during the dry period, whereas, the red-bellied and black piranha were the most abundant during the high water periods (Figure 16).

Since the substantial increase in fish abundance in the second half of the decade the fish populations have been relatively stable, both in numbers and biomass. However, during the drought period there was a substantial decrease in fish numbers during the lowest water level. The fish populations prior to the receding waters had a greater abundance than average in the Samiria (10 ind/hour compared to 5.3 ind/hour). However, as the waters receded the abundance of fish started to decline and in July fish numbers were below average (10.6 ind/hour compared to 11.3 ind/hour). As the season progressed and the water levels sank below the long term levels the fish abundance became obviously lower than average with a 63% decrease from normal years (4.5ind/km compared to12.2 ind/hour).

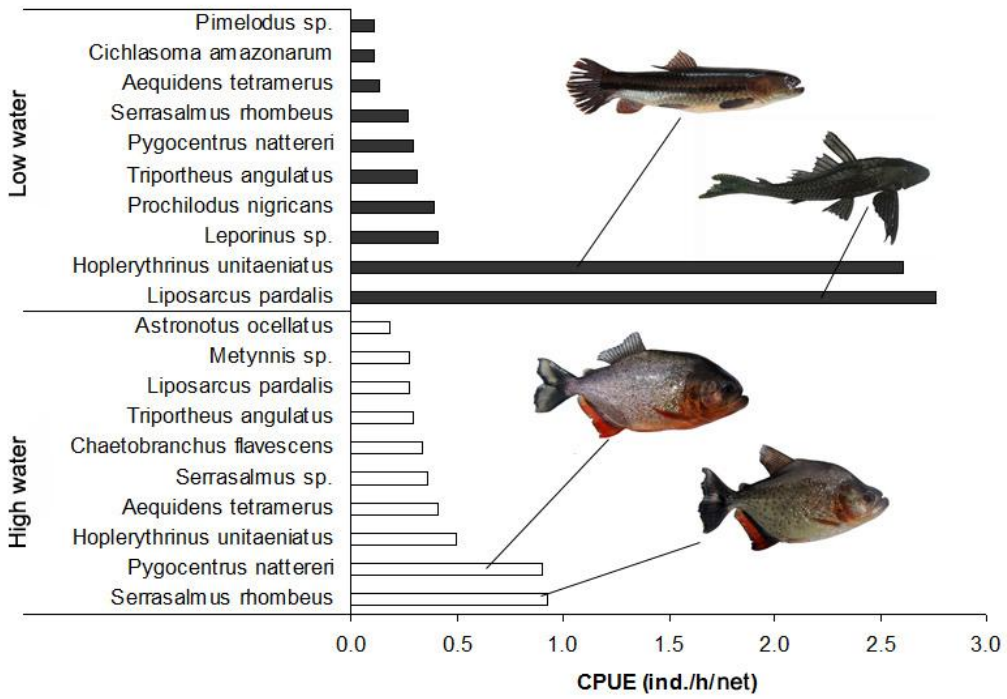


Figure 16. Seasonal variation in fish abundance measured as CPUE in the Samiria River.

Objective 12: Camera Traps

The cameras had technical problems in 2010 and very small sample sizes were conducted. In 2011 we have begun a seven month intensive camera trapping project that will run from February to August with 40 rebuilt digital cameras.

Objective 13: Community based Management Groups

The project worked closely with the Cocama Indian villages of San Martin, Boliva, Nuevo Arica and Leoncio Prado on the management group conservation initiative. Management groups are formed by members of a Cocama community and take responsibility for different areas of the reserve or different management activities. For example, there are management groups that run the local community-based tourism, other management groups manage specific lakes within the reserve, others assist with the turtle programme, and others support the park stations.

Management groups require the permission of the Reserve Administration and are required to produce a management plan for their activities. The Earthwatch project works with the management groups in developing and implementing the management plans. This is done by: 1) providing guidance on the importance of the management plans, 2) working with the management groups in developing the management plans, 3) ensuring that the plans are sustainable and do not damage the natural resources or wildlife populations, 4) provide technical data on the population status of species through the monitoring censuses, and 5) helping to present the plans to the Reserve Authorities.

In addition, the project works closely with the Reserve Authorities, providing them with the quantitative data on wildlife populations, and helping with logistical support. The project is also involved with a variety of conservation activities led by the Reserve Authority, such as the turtle programme and wading bird surveys among others.

Objective 14: Historical Conservation

The project is continuing with the historical conservation of the rubber boom era. The historic boats, Ayapua and Clavero, are used during the fieldwork in an effort to combine both biodiversity and historical conservation. The project also finished the historic restoration of a rubber boom era mansion in Iquitos, La Casa Morey, which is used by Earthwatch volunteers during their stay in Iquitos. The project has further plans for the restoration of two historic boats, the Pithecia and the Rio Amazonas, both dating from the late 19th century, and the publication of a book on Steamboat Navigation in the Peruvian Amazon during the Rubber Boom Era.

Updates to objectives

I am planning to expand the project and build on the success of the peccary certification programme by adding a component on rubber certification. The proposal is being developed in collaboration with the Gordon and Betty Moore Foundation. Preliminary work has been conducted and I will be developing a component for volunteer participation, which will include tapping of rubber trees. Below I outline the background of the proposal.

<u>Long-term conservation of Amazon forests through catalyzing community-based conservation using economic incentives.</u>

After 25 years of developing community-based conservation in numerous Amazonian landscapes through solid research, dedicated participatory implementation and clear policies a robust conservation strategy has emerged. Community-based conservation is the key to

successful conservation of the Amazon through community management of natural resources. Research has clearly shown the positive results of community involvement for biodiversity conservation in the Amazon. Local communities have long-term interests in conserving intact forests and rivers, since these provide the basic needs of food, shelter, medicines, and products for interchange and sale. Community-based management plans form the basis of consolidation and have clearly led to the current situation, which can be summarized as increasing areas under protection with solid long-term community-based conservation strategies. Community-based conservation is a financially sustainable strategy for conservation over the long-term, since it is self financed by the communities themselves, and does not require long-term external investments.

The opportunities for expansion of community-based conservation are imminent and are definitely occurring. Economic incentive strategies are acting as catalysts for ever greater numbers of communities to help conserve the Amazon forests, and increasing capacity building will ensure a large and ready pool of trained professionals to take on the growth of conservation responsibilities. The challenges from the petroleum industry, unsustainable timber extraction and other destructive activities will best be confronted by a strong community-based strategy. The baseline of community-based conservation has been established, tested and implemented and has been shown to be solid and robust.

Peccary pelt certification as a Model for Catalyzing Community-based Conservation

Bush meat hunting is an important economic resource that has been traditionally used by rural poor of the Peruvian Amazon. Rural people hunt mammals for subsistence food and to sell meat and hides in urban markets. If well managed, bush meat hunting can provide long-term socio-economic benefits to local communities and help conserve Amazonian biodiversity through maintaining intact rainforests. If poorly managed, bush meat hunting will lead to the extirpation of animal populations, reduced socio-economic benefits that rural people obtain from wildlife, and a decreased value of intact forests.

The peccary pelt certification program is a mechanism to help local communities convert unsustainable practices to more sustainable practices using the economic incentive of peccary pelts as the catalyst that causes the change. Local communities are certified if they manage all of their bush meat hunting sustainably and conserve intact forests for the wildlife species. Certified communities sell peccary pelts at a premium and obtain added value through their conservation efforts.

Communities that manage their wildlife sustainably become certified and in turn, secure added income from the sale the peccary pelts, and became recognized as responsible environmentally sensitive communities that are helping to save the Amazon rainforest. With an increasing number of communities becoming certified the program is enhancing the conservation of Amazon forests, providing added income for rural families and demonstrating the importance of the environmentally sensitive consumer as a driver for conservation of the Amazon rainforests.

Economic Catalysts opposed to Economic Alternatives

The lessons learnt from community based conservation and the peccary pelt certification program are helping form a larger and more robust conservation strategy for the Amazon basin. Economic incentives that act as catalysts to help local people implement community-based conservation are needed, not economic alternatives. The local people in the Amazon have an economic strategy based on hunting, fishing, non-timber plant products and small scale agriculture. This is the basis of their economy. These activities can be done in a sustainable manner that helps conserve species, forests, ecosystems and local cultures, or they can be done in a non-sustainable way that results in overexploitation of species,

destruction of forests and degradation of their ecosystem and cultures. What are needed are economic incentives that help communities convert unsustainable practices to sustainable practices. The peccary pelt certification program has shown that this is a real alternative strategy that can lead to long-term conservation based on community management, both inside and outside of protected areas. There is no reason to try and find new economic alternatives. The local people of the Amazon have a solid economic base. What is needed is to find ways of insuring that this economic base works towards conservation and not opposed to conservation.

This strategy can be equated to a chemical reaction. On the left side of the equation is unsustainable use and on the right side is sustainable use. The catalyst that causes the change (reaction) is an economic incentive.

1. Unsustainable use + Economic incentive → Sustainable use

This is how it works for the peccary pelt certification program.

2. Overhunting + Peccary pelt certification → Sustainable hunting

<u>Rubber extraction to help conserve the Amazon through community-based conservation: the green rubber project</u>

Natural rubber extraction could potentially be an influential mechanism to help local people change their unsustainable practices to community-based conservation practices. This is how it would work:

3. Unsustainable uses + natural rubber extraction → Community-based Conservation

Currently there is no significant market for natural rubber from the Amazon and people are no longer extracting this resource. Virtually all of the natural rubber comes from plantations in Southeast Asia. Between 1880 and 1920 natural rubber from the Amazon was a very important product and resulted in the greatest economic era of the Amazon basin. When the rubber plants were exported to Asia and plantations developed the increased production and lower labour costs resulted in the crash of natural rubber extraction and an end to the economic returns from natural rubber. Unfortunately, this led to an era of overharvesting other natural resources, such as animal pelts, timber and fish as a way for people to continue their ambitions of economic advancement. Over a 100 year period the Amazon has seen innumerable destructive practices as people have tried to recreate the economic boom of the rubber period.

Rubber extraction was a very sustainable practice, since the trees are tapped and not felled. However, plantations are not possible in the Amazon, because of the natural disease of leaf blight that kills the trees if they are too dense. Henry Ford was one of the first to discover this when he developed a rubber plantation in the Brazilian Amazon (Fordlandia) which failed when all the trees died of leaf blight. The Asian plantations do not have this disease, since it only occurs in South America. The sparser distribution of natural rubber trees does not result in the death of the trees.

The current proposal is based on the lessons learnt from the experiences of community-based conservation; peccary pelt certification and the importance of economic incentives as catalysts for change. The rubber extraction program would work as follows:

1) Communities that set up sustainable resource management of their hunting, fishing, natural resource extraction and agricultural practices would become certified as

responsible environmentally sensitive communities that are helping to save the Amazon rainforest.
2) A Certification Body would oversee the process of certification and verify the continuation of sustainable resource management.
3) Natural rubber extracted by these communities would be sold to high end car manufacturers (via tire companies) to produce high quality tires for the luxury automobile market. Rubber is still required for the manufacture of automobile tires.
4) The automobiles that have these tires would have ecological credits, possibly even carbon credits. The consumers would understand that the higher purchase price is helping to save the Amazon forests, offset global warming, and be environmentally correct. The car dealers would have a marketing edge by showing how they are helping to save the environment.
5) The economic incentives provided by the sale of natural rubber would help communities change from unsustainable practices to conservation practices through sustainable resource management. This would start a "snow ball" effect and more and more communities would want to participate in the certification program, which would hopefully result in a major change throughout much of the basin and be a major strategy for the future conservation of the Amazon.

REPORTING AGAINST MEASURES OF SUCCESS (MoS)

Partnerships

The Peruvian Ministry of the Environment and the Pacaya-Samiria National Reserve

The Peruvian Ministry of the Environment is the Peruvian government office responsible for implementing and managing protected areas, including the Pacaya-Samiria National Reserve. Collaborations with The Peruvian Ministry of the Environment and the Pacaya-Samiria National Reserve both at the national level in Lima and the regional level in Iquitos were realised with the project and the other host country partners. The Peruvian Ministry of the Environment and the Pacaya-Samiria National Reserve has been, and continues to be, involved in many aspects of the project and the wildlife monitoring. Co-ordinations between The Peruvian Ministry of the Environment and the Pacaya-Samiria National Reserve and the project were continual during this past year.

Durrell Institute of Conservation and Ecology (DICE)

DICE, based at the University of Kent, Canterbury UK, is the home institution of the lead scientist and plays an important role in the project. Students and staff from DICE help with field expeditions and provide an academic base for the research activities.

Wildlife Conservation Society (WCS-Peru)

The Wildlife Conservation Society (WCS-Peru) is actively collaborating with the project. WCS-Peru helped co-ordinate monitoring expeditions, workshops and field-based courses on the wildlife conservation and management with the reserve, local communities and universities.

The Gordon and Betty Moore Foundation

The Gordon and Betty Moore Foundation is helping to support capacity building of local professionals and is interested in helping support the rubber certification programme. Funds will be managed by WCS and FundAmazonia for these initiatives.

The Universidad Nacional de la Amazonia Peruana (UNAP)

The Universidad Nacional de la Amazonia Peruana (UNAP) participated closely with the project. Undergraduate and postgraduate students from UNAP were involved with field courses and field training as part of the project during the past year. Students participated with the wildlife censuses, community-based activities and data analysis.

Fundacion para la conservacion del Tropico Amazonico (FUNDAMAZONIA)

FundAmazonia is a locally based NGO in the Peruvian Amazon that was specifically created to help support conservation activities. FundAmazonia´s mandate is to support local capacity building for conservation projects, help local communities set up community based wildlife management programmes, assist protected areas in wildlife conservation, and promote conservation oriented research activities. FundAmazonia is playing an important role in the project by co-ordinating the activities with partners and stakeholders in Peru.

Universidad Particular de Iquitos (UPI)

Undergraduates from the Department of Ecology and Conservation from the Universidad Particular de Iquitos (UPI) participated in monitoring expeditions, field courses and field training activities. UPI has recently begun its academic division in ecology and conservation and is set to be an important institution for this field. UPI plans to continue its collaboration with the project over the coming year.

AmazonEco

AmazonEco provides logistics for conservation and research expeditions to the Peruvian Amazon and collaborates with the project by logistical provisioning of the monitoring expeditions to the Samiria River.

Contributions to conventions, agendas, policies, management plans

International

The project continued its collaboration with CITES (The International Convention on the Trade of Endangered Species) through the work on developing a peccary pelt certification programme.

National or regional

The project provided technical information to the Pacaya-Samiria National Reserve management plan, which was completed in February 2010.

The project provided technical information to the fauna regulations being developed by the Office of Forestry and Fauna and the Ministry of the Environment, Peru.

The project provided technical information to the protected area management regulations being developed by the Ministry of the Environment, Peru.

Local

The project provided technical information, capacity building and logistical support to the local Cocama management groups of the villages of San Martin, Bolivar, Nuevo Arica and Leocio Prado located in the mouth of the Samiria River to help in developing management plans.

The project provided technical information, capacity building and logistical support to assist the park ranger stations in implementing the Pacaya Samiria Management plan along the Samiria River.

Dissemination

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Visual

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Cosier, S. (2010) Over the Rainbow. Audubon Magazine July/August pp. 48-50.
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Meetings and conferences

Workshops on the peccary pelt certification programme.
Workshops with Management Groups in the Samiria River

Developing Environmental Leaders

1) BSc students from the local universities of Iquitios (UNAP and UCP). 45 BSc students participated in field courses in the Samiria River basin as part of the project. The courses focused on wildlife conservation, community based conservation and protected area management.
2) BSc students from the UK, USA and Canada. Students were trained in wildlife conservation, tropical ecology, community based conservation and protected area management. Many students conducted individual projects as part of their learning experience.
3) One MSc student conducted her thesis research as part of the project.

Long term impact of project

Taxa of conservation significance enhanced, restored or maintained

The conservation of the species listed below, among others described in this report, were enhanced through management and conservation actions done by the project in collaboration with the reserve authorities and local communities of the Pacaya-Samiria National Reserve.

Pteronura brasiliensis (Giant Otter) Status: Endangered A3cd
Lagothrix lagotricha (Humboldt's Woolly Monkey) Status: Vulnerable A3cd
Tapirus terrestris (Lowland Tapir) Status: Vulnerable A2cde+
Podocnemis unifilis (Yellow-spotted Sideneck Turtle) Status: Vulnerable A1acd
Trichechus inunguis (South American Manatee) Status: Vulnerable A3cd
Tayassu pecari (White-lipped Peccary) Status: Near Threatened

Habitats enhanced, restored or maintained

Amazonian flooded forests of the Pacaya-Samiria National Reserve were conserved through management and conservation actions done by the project in collaboration with the reserve authorities and local communities.

Ecosystem services enhanced, restored or maintained

The ecosystem services provided by the Amazonian flooded forests, including fisheries reproduction, water quality maintenance, soil conservation, nutrient cycling, seed disperal, primary production and carbon sequestration among others was maintained through management and conservation actions done by the project in collaboration with the reserve authorities and local communities of the Pacaya-Samiria National Reserve.

Cultural heritage enhanced, restored or maintained

The project supported the tangible cultural heritage through the restoration of the following boats and building in the Amazon of Peru. The boats were used for biodiversity conservation fieldwork.

1) The maintenance of the restored rubber boom epic steam boat "Ayapua" built in 1906.
2) The continued restoration of the historic naval steam boat "Clavero" built in 1876, which is the oldest boat on the Amazon.
3) The maintenance of two restored historic steam launches and one restored historic life boat.
4) Finished restoration of a rubber boom period mansion built between 1910-1913 in Iquitos, Peru, La Casa Morey.

Livelihood assets enhanced, restored or maintained

The livelihoods of local Cocama indigenous people in the villages of the mouth of the Samiria River were enhanced and maintained by the project. Approximately 150 people were affected by the project, which included aid for education, health and conservation projects, in addition to capacity building.

Describe the nature of the relationship between your research team and the local community during this field season

Local people are a key component to the community based conservation that the project has been implementing over the past 20 years.

1) Local people are involved in all levels of the conservation actions.
2) Local people implement the conservation management plans.
3) The project provides capacity building, technical information and logistical support.
4) Participatory workshops are used to develop an interactive forum for community participation, which includes feedback.
5) Participatory monitoring allows for the project and local communities to have a continual interchange of ideas, information and approaches to conservation.

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