



These reports are primarily used by WCS staff for program review and evaluation, for planning future budget needs, and to provide a history of our programs and projects. Information in the reports is also used for fundraising and publicity purposes.
Please remember to date your report and number your pages

GUIDELINES FOR SIX MONTH REPORTS

DUE: JULY 15TH AND JANUARY 15TH

Date Submitted: March 30, 2007

1. PROJECT TITLE :

Establishment of permanent camera trapping stations for continued jaguar monitoring in The Chiquibul Forest of Belize

2. **REPORT SUMMARY** – Briefly summarize the rationale, goals, objectives and problems to be addressed. Provide sufficient background information so that anyone unfamiliar with the project can understand its overall goals and objectives. In addition, this section should summarize your progress in the past 12 months toward achieving project objectives. The Executive Summary should be written with an external audience in mind (donors, press, etc.) —in a non-technical style and not to exceed one page.

EXECUTIVE SUMMARY

Background: In 2002, when this camera trapping study for jaguars began, there were relatively few illegal *Chamaedorea* (xaté) palm poachers working the Chiquibul Forest. *Chamaedorea* is the genus name for a group of small under story palms (also called fishtail palms) that are used in the flower industry as green back-drop for more colorful flowers. They are attractive leaves that can last for up to 45 days after being cut making them popular for flower arrangements, Palm Sunday services, and decoration. Xaté harvest (both legal and illegal) is a lucrative business and xaté poaching has increased in the Chiquibul forest accompanied by establishment of illegal xatero camps inside Belize. Xateros began stealing cameras in 2003 even though cameras were locked with braided steel cables to large trees. Xateros use machetes to hack away at cables, or they cut down trees to steal cameras.

This site has already built up a substantial database on jaguar population density over the past 2002-2005 and local Belizeans field assistants have been trained in camera trapping methodology. Due to its proximity to the Guatemalan border, this site can function as an indicator of jaguar health in the Maya Mountains as a whole because the area is contiguous with Cockscomb Basin Wildlife Sanctuary and the Bladen Nature Reserve. The continuation of this long-term study is currently contingent upon establishment of permanent, theft-proof, camera stations that I proposed for this grant in 2006 (see original proposal for construction plans).

Progress narrative: Construction of permanent concrete camera trapping “pods” began in June 2006. We purchased materials in Belize for mixing and pouring concrete and we also brought equipment with us from the US (concrete vibrator, portable drills, etc.). This work was extremely labor intensive

because the material for a single pod weighs between 450 and 500 lbs., and we constructed 2 pods per station. We drove to most stations via old, unmaintained, logging roads, but hard rain came early in June causing our vehicle, loaded with 1-2,000 lbs of concrete material and equipment, to become stuck in the mud over 15 times in first 2 weeks (maximum was 4 times in one day). This often required us to unload and push the vehicle out of the mud, reload equipment, and then reach the location where we then mixed 1000 lbs of concrete and poured it into the 2 forms at each site.

Field technician, Eddie Owens (recently out of the Marines after 8.5 years and 2 tours of duty), politely commented that he had never worked that hard in the Marines and that he would probably never work for me again. But his heroic efforts and upbeat attitude should not go un-mentioned. The skills of Tom Mc Namara, carpenter and pod designer, should also be mentioned as he dealt with less than ideal conditions, different available materials than expected, and was an expert concrete mixer. Local technicians, Victor Quiroz and Isidro Bol also provided much assistance in the form of physical labor, comic relief, and the wisdom of Belizean techniques to improve our efficiency. We hiked to one station using the labor force of 15 U.S. undergraduate students from a tropical ecology course at Las Cuevas Research Station, making 2 complete (3km) trips with backpacks full of dry concrete and water.

By the end of July we completed 13 camera stations (26 pods). In November 2006, I made a second trip to Belize with Tom Mc Namara, and, with the help of Victor Quiroz, we built 2 more stations (4 more pods) for a total of 15 stations built (30 pods). We then put DeerCam remote cameras inside metal housings and bolted them with concrete screws inside the camera trapping pods and ran the 15 camera trapping stations from November 2nd 2006 to January 4th 2007. Victor Quiroz monitored cameras from mid-November until my return in January 2007.

Results narrative: Of the 15 permanent camera stations established, 5 were vandalized by Guatemalan xateros. In 4 out of the 5 vandalized camera stations, 1 or 2 cameras were broken or stolen from the pods at each of these stations. It is unclear exactly how xateros were able to bend metal housings to the point of breaking. Broken sticks were the only tools found near pods. The 5th vandalized pod was not breached. All pods, and backings for metal housings remained intact and are still usable. Lack of funding did not allow for the completion of film development until mid-March. While data analysis is still underway, preliminary results indicate that we captured 6 jaguars across the 12 camera stations where we retrieved film. Data entry, mark-recapture analysis, and population size estimates are currently underway and should be completed by the end of April 2007.

Prognosis: Before pod construction, no camera was safe at the field site. We have improved this situation substantially. After conferring with Victor Quiroz and Nicodemus Bol, I feel that with a few minor modifications to the current design we can strengthen what we know to be the weak points in the metal housing surrounding the cameras to prevent theft. This modification should be inexpensive and relatively simple to implement. Additionally, this project brought high visibility to the xatero issue in the Chiquibul Forest and has lead to new collaborations with Friends for Conservation and Development (FCD) who will now work with the jaguar project (please see Section 13 below for more detail).

3. SUMMARY LINE (1-2 sentence description of project):

This project in establishing permanent, theft-proof camera trapping stations for the continuation of long-term jaguar monitoring in the Chiquibul Forest Reserve and National Park.

4. PROJECT LEADERS: MARCELLA J. KELLY

5. OTHER STAFF: Number of people who work on project in the last 6 months: full-time __, part time 5 (include names of key people):

Victor Quiroz
Isidro Bol
Nicodemus Bol
Thomas Mc Namara
Edward Owens

6. COLLABORATORS and other Institutional affiliations:

Chris Minty: Las Cuevas Research Station and Edinburgh University
Victor Quiroz; Isidro Bol, Nicodemus Bol: Las Cuevas Research Station
Derric Chan and Rafael Manzanero: Friends for Conservation and Development

7. PROJECT DURATION with begin date, and end date if project completed:

June 2006 – December 2007 for establishment of theft-proof camera trapping stations. However, monitoring of the jaguar population has no end date. Surveys will continue to be conducted at least once per year.

8. APPROVED BUDGET for current fiscal year:

See attached Excel budget sheet

9. Description of ACTIVITIES/PROGRESS over last 6 months (referencing your WORKPLAN):

My team established 13 permanent camera trapping stations with 2 concrete “pods” each in June-July 2006. In November 2006 we established 2 more stations for a total of 15 stations and 30 pods built. The original goal was to establish 20 stations (40 pods), therefore we completed $\frac{3}{4}$ of our original goal. Considering the unanticipated difficulties of this project, especially the intense labor required and the difficulties of reaching sites, I am pleased with the results.

I was able to conduct a 2006 survey from November 2nd until January 4th. Vandalism by xateros did occur but we were able to retrieve film from 12 camera stations. We did capture at least 6 jaguars across 12 of stations and data analysis is currently underway for estimating jaguar density.

10. EXPLORATORY ACTIVITIES (not included in Workplan): Briefly describe any activities implemented during the reporting period that were not originally in your workplan.

We originally planned to complete 20 camera trapping stations, but after numerous conversations with the Forestry Department and Friends for Conservation and Development (FCD), it became clear that there is interest on their end to put some of the stations inside the National Park borders rather than just within the Forest Reserve boundaries. The National Park has a different protected status, that of full protection while the Forest Reserve allows mining, and timber and non-timber forest product extraction. Currently all stations are only within the Forest Reserve boundaries

and not the National Park, although several stations border the National Park. Therefore, I explored new areas within the National Park where the survey could be expanded. In addition, FCD is also using their patrol team to further explore new areas for establishing stations. Certainly and comparison of these two areas would be very interesting biologically to determine the effects of disturbance (in the form of resource extraction) on the jaguar population.

11. PROBLEMS AND CONSTRAINTS - This section can be written on a separate page and, if necessary, marked confidential. Please put confidential items in a SEPARATE electronic file, clearly marked "CONF" so that it is not inadvertently forwarded. Sections thus marked will NOT be circulated.

The main concern with the Chiquibul Forest and National Park jaguar surveys is not building more pods (as difficult as that is), but rather is the increasing activity of the xateros in the area. One of the vandalized camera stations had a note etched into the back of the metal DeerCam housing that read, "Yo Kaibil, JP, Jamas Retrocedo". The translation for this is "I am Kaibil, never step back". From my Belizean technicians and FCD, I learned that Kaibil is the word Guatemalan army force. This means that there may be Guatemalans who were formerly in the army in the Chiquibul forest and that are not afraid of us and are not going to stop doing what they are doing (illegally harvesting xaté). They have also left much more aggressive notes for the Belize Defense Force and they seem to have no fear of having their photographs taken by remote cameras. It is essential that this activity be stopped in the Chiquibul Forest because it has already led to the establishment of semi-permanent Guatemalan xatero camps inside Belize. In addition, xateros have been found as far as 40 km inside the Chiquibul and even into the Cockscomb Basin Wildlife Sanctuary. There has been land clearing by fires in the Chiquibul Forest along the Guatemalan border and unless this activity is stopped, the forest will rapidly be depleted or destroyed. This is perhaps the most serious issue affecting the viability of the Chiquibul Forest and my project has helped document these activities through photographs and reports of vandalism of the Forestry Department.

12. GOALS/ACTIVITIES FOR THE NEXT YEAR – reference WORKPLAN

I plan to expand and complete establishment of the permanent camera trapping stations in The Chiquibul Forest Reserve and National Park. In addition, I plan to add extra security features to the current trapping stations which should prevent theft. By early November 2007, I plan to have 10 more permanent camera stations (20 pods) built. This would give a total of 25 camera stations with 20 within the Chiquibul Forest Reserve and 5 within the National Park. All will be at a distance of roughly 3 km apart. I will then run the 2007 camera trapping survey from November through December 2007.

13. CONSERVATION ACCOMPLISHMENTS & EVALUATION: this section should be a reflective analysis of project outcomes and effectiveness.

I believe that the permanent camera trapping stations were fairly effective at preventing theft. While we did have 5 of 15 stations vandalized by Guatemalan xateros, and cameras stolen from 4 of these, the pods themselves were not disturbed and minor modifications to the metal housings encasing the DeerCams should prevent further theft.

The most constructive event occurring as a result of the vandalization of the trapping pods was heightened awareness of the seriousness of the xatero issue in the Chiquibul Forest. In January 2007, Friends for Conservation and Development (FCD) hired an 8 man patrol team (funded by Conservation International) to patrol the Chiquibul Forest. I met with them only days after they were hired in January. I took them to several of the vandalized camera stations. Along with Derric Chan and Rafael Manzanero, we strategized a rapid response plan for the future camera trapping surveys when vandalism is suspected. In addition, the patrol team agreed to increase patrols in areas where cameras are located during the times of surveys. One of FCD's missions will be to document the incursions and try to reduce activity. We plan to use a number of different metrics to assess activity and one of those will be the amount of camera disturbance as well as the trap success of humans (xateros) caught on film from the remote cameras. At the present time, Xateros do not appear to avoid cameras and will simply pass by them. From those arrested over the past year, they feel that Belize belongs to Guatemala at that what they are doing is not illegal. Therefore, they willingly have their photographs at camera stations.

14. LIST OF PUBLICATIONS DURING PAST 6 MONTHS: List any articles or books published and/or in press (popular and technical), as well as "gray literature" (e.g., management plans, field surveys, etc.). *Please attach/mail reprints or copies if you have not submitted them already.*

Dillon, A.G. and M.J. Kelly. In Press. Ocelot activity, trap success, and density in Belize: the impact of trap spacing and animal movement on density estimates. *Oryx*.

Kelly, M.J.; Noss, A.J.; Di Bitetti, M.S.; Maffei, L.; Arispe L., R.; Paviolo, A.; DeAngelo, C.D; and Y.E. Di Blanco. Under Review. Estimating puma densities from camera trapping across three study sites: Bolivia, Argentina, Belize. *Journal of Mammalogy*.

Note: These 2 papers are not specifically from this past 2006 project, but they did cover other research funded by WCS.

THESE ADDITIONAL MATERIALS SHOULD BE SUBMITTED WITH THE JULY 15TH REPORT:

1. NEW/UPDATED CVs: - We need to have current CVs on file for all WCS staff (not just P.I.'s). CVs may be sent to us at any time, but please use the annual report to attach CVs of any new personnel or updated CVs if not submitted since last annual report.

See following pages

2. SLIDES – Please send 5-10 hard-copy slides per project (fewer if you manage many projects) labeled with photo credits for publicity and other non-commercial uses. Please include photos of you and staff, the species studied, and other high-quality contextual slides. Please provide on a separate sheet a short descriptive paragraph about each slide.

See following pages

MARCELLA J. KELLY- Assistant Professor
Dept of Fisheries and Wildlife Sciences; Virginia Tech
146 Cheatham Hall; Blacksburg, VA 24061-0321
PH (540) 231-1734; FAX (540) 231-7580; makelly2@vt.edu

EDUCATION

B.S. 1991 University of California, Davis. Wildlife and Fisheries Biology
Ph.D. 2000 University of California, Davis. Ecology. Advisor: Dr. Tim Caro

PROFESSIONAL EMPLOYMENT

2001 – present Assistant Professor, Department of Fisheries and Wildlife Sciences
Virginia Polytechnic Institute and State University, Blacksburg, VA.
1999 – 2001 Adjunct Professor, Biology Department
San Francisco State University, San Francisco, CA.

TEACHING EXPERIENCE

Undergraduate courses:

Population Dynamics and Estimation (Virginia Tech), 2003 - present
Wildlife Field Techniques (Virginia Tech), 2001-present
Tropical Ecology and Conservation (SFSU), 1998 - 2002
Wildlife Ecology (U.C. Davis), 2000
Teaching Assistant for 15 courses while a graduate student at U.C. Davis, 1993-2000

Graduate Courses:

Carnivore Conservation Seminar (Virginia Tech), 2001
Advanced Topics in Applied Population Ecology (Virginia Tech), 2003- present

RESEARCH SUPPORT (SELECTED)

- 2006-present. Tiger Conservation in Sumatra. World Wildlife Fund, \$24,500.
- 2004-2006: Horseshoe crab population modeling. National Marine Fisheries Service, \$62,000.
- 2003-2006: An evaluation of Quality Deer Management. Deer Hunters Association, \$95,652.
- 2003-present: Remote camera reliability for wildlife study. Acorn Alcinda Foundation, \$39,000.
- 2002-2004: Small mammal abundance and community composition across a harvested landscape. MeadWestvaco, \$32,000.
- 2001-2002. ASPIRES, Virginia Tech. The Center Woods Wildlife Research and Training Center. \$36,000 plus matching funds. Total \$66,000.
- 2000-present: The use of remote cameras for monitoring jaguars in Western Belize, Central America. Wildlife Conservation Society, Philadelphia Zoo, Other Private: \$43,000

OTHER RESEARCH EXPERIENCE

2004-2006: Research and Capacity Building. Collaboration with the Carnivore Center of the Tanzanian Wildlife Research Institute (TAWIRI), and the Zoological Society of London (ZSL), Advisor for a country-wide, remote camera survey protocol for 35 species of carnivores.

2000: Researcher, University of California, Davis. Endangered Stephen's kangaroo rat census and habitat requirements in Riverside County, Southern California.

1999 - present: Long-term monitoring project examining diversity and abundance of neotropical rainforest mammals at Las Cuevas Research Station, Belize, San Francisco State University.

1996 - 1997: Researcher: Institute of Zoology, Zoological Society of London, England. Collaborated with Dr. Sarah Durant to conduct a population viability analysis for cheetahs.

1993 – 2000: Dissertation research. The use of photographic identification of Serengeti cheetahs to determine population demography, viability, effective population size.

1990-1991: Research Assistant: analysis of data on tail flagging in white-tailed deer.

1989: Research Assistant, Bodega Marine Laboratory, Dr. A. Peter Klimley. Using ultrasonic telemetry to track the movements and behavior of scalloped hammerhead sharks.

REFERREED PUBLICATIONS (*graduate, ** undergraduate students under my direction)

*Laver, P.N. and M.J. Kelly. (Accepted Pending Revision). Comparing home range estimators and a new application for ArcGIS. *Journal of Wildlife Management*

*Laver, P.N.; Kelly, M.J.; Caro, T.M. and S.M. Durant. (Accepted Pending Revision) Moss or rolling stone? Home range in a “migratory” carnivore *Journal of Wildlife Management*.

*Batts, G .K.; Lafon, N. W.; Kelly, M.J. and M. R. Vaughan (In Press). A modified approach to rocket netting white-tailed deer using a remote video. *Proceedings of the Southeastern Association of Fish and Wildlife Agencies*.

*Dillon, A.G. and M.J. Kelly. (In Press). Ocelot activity, trap success, and density in Belize: the impact of trap spacing and animal movement on density estimates. *Oryx*.

*Kaminski, J.A; Klopfer, M.L.; Keyser, P.D. and M.J. Kelly. (In Press). Disturbance Effects on Small Mammal Communities in a Managed Appalachian Forest. *American Midland Naturalist*

Davis, M; Berkson, J, and M. Kelly. 2006. Delaware Bay Horseshoe Crab (*Limulus polyphemus*) Population Assessment Using a Surplus Production Model. *Fisheries Bulletin 104: 215-225*.

Noss, A.J.; Kelly, M.J.; ** Camblos, H.B. and D.I. Rumiz. 2006. Pumas y Jaguares Simpátricos: Datos de Trampas-Cámara en Bolivia y Belize. *MEMORIAS: 229-237*

Silver, S.C.; Ostro, L.E.T.; Marsh, L.K.; Maffei, L.; Noss, A.J.; Kelly, M.J.; Wallace, R.B.; Gomez, H. and G. Ayala. 2004. The use of camera traps for estimating jaguar abundance and density using capture/recapture analysis. *Oryx 38: 148-154*.

Durant, S.M.; Kelly, M.J. and T.M. Caro. 2004. Factors affecting life and death in Serengeti cheetahs: Environment, Age and Sociality. *Behavioral Ecology 15: 11-22*

Kelly, M.J. 2003. Jaguar monitoring in Western Belize. *Caribbean Geography 13: 19-32*.

Kelly, M.J. and T.M. Caro. 2003. Low density of small mammals at Las Cuevas, Belize. *Mammalian Biology 68:1-15*

Maehr, D.S.; Kelly, M.J.; Bolgiano, C.; Lester, T. and H. McGinnis. 2003. Eastern Cougar recovery is linked to Florida panther: Cardoza and Langlois revisited. *Wildlife Society Bulletin 31: 849-853*.

Kelly, M.J. 2001. Conservation consequences of lineage loss, reproductive variance, and heritable fertility in Serengeti cheetahs. *Conservation Biology. 15: 137-147*.

Kelly , M.J. 2001. Computer aided photograph matching in studies employing individual identification: An example from Serengeti cheetahs. *Journal of Mammalogy. 82: 440-449*.

Caro, T. and M.J. Kelly. 2001. Cheetahs and their mating system. Pages 512-532 in Model systems in behavioral ecology. L.A. Dugatkin editor. Princeton University Press.

Caro, T.; Brock, R.E. and M.J. Kelly 2001. Diversity of mammals in the Bladen Nature Reserve, Belize, and factors affecting their trapping success. *Mammalian Biology*.66: 90-101.

Caro, T.; Kelly, M.J.; Bol, N. and S. Matola. 2001. Inventorying mammals at multiple sites: the Maya Mountains of Belize. *Journal of Mammalogy*. 82: 43-50.

Kelly, M.J. and S.M. Durant. 2000. Viability of the Serengeti cheetah population. *Conservation Biology* 14: 786-797.

Gros, P.M.; Kelly, M.J. and T.M. Caro. 1996. Estimating carnivore densities for conservation purposes. Indirect ecological methods compared to long term field studies. *Oikos* 77: 197-206.

Kelly, M.J.; Laurenson, M.K.; FitzGibbon, C. D.; Collins, D. A.; Durant, S.M.; Frame, G.W.; Bertram, B.C.R. and T.M. Caro. 1998. Long-term demography of the Serengeti cheetah population: the first 25 years. *Journal of Zoology, London* 244: 473-488.

Caro, T.M.; Lombardo, L.; Goldzien, A.W. and M. Kelly. 1995. Tail-flagging and other anti-predator signals in white-tailed deer: new data and synthesis. *Behavioral Ecology* 6:442-450.

PAPERS IN REVIEW

Kelly, M.J.; Noss, A.J. Di Bitetti, M.; Under Review. Estimating puma densities from remote cameras across 3 study sites: Bolivia, Argentina, and Belize. *Journal of Tropical Ecology*

Laver, P.N.; Kelly, M.J. Caro, T. and S.M. Durant. Under Review. Moving in Social circles: Philopatry and interaction in Serengeti cheetah. *Behavioral Ecology*.

DIVERSITY CONTRIBUTIONS

McNair Scholar's program, Concord College, WV. Guest speaker for seminar series, 2003

McNair Scholar's program, Virginia Tech. Mentor for summer research program 2002.

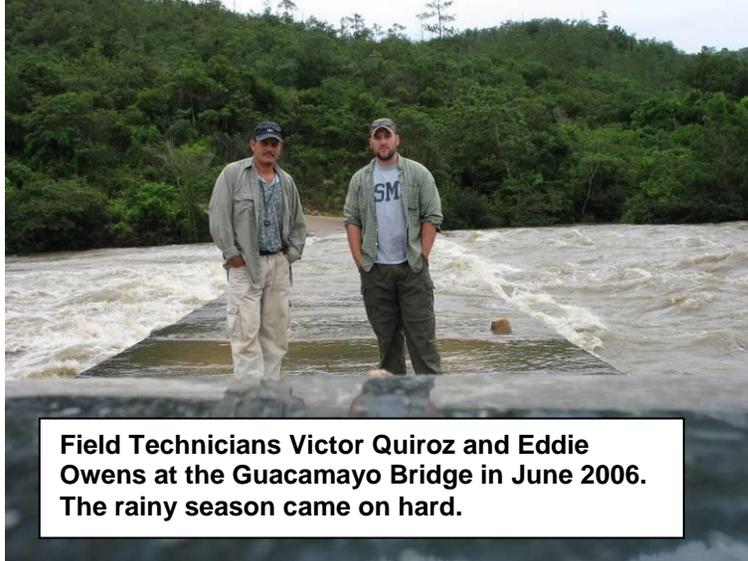
Girls in Science, UC Davis. Speaker and workshop leader for Junior High girls, March 2000.

HONORS AND AWARDS

- January 2006–present; Research Associate–Institute of Zoology, Zoological Society of London
- August 2006-FiW, Curriculum Club Award for Excellence in Teaching.
- March 2005-College of Natural Resources, Curriculum Club Award for Excellence in Teaching
- May 2003- Graduate Student Appreciation award; Virginia Tech.
- June 2001- Merton-Love Award for best Ph.D. dissertation in Ecology. UC Davis.
- June 2001- Finalist for Best Student Paper. Society for Conservation Biology, Missoula, MT.
- June 1998- Campus-wide award for Outstanding Graduate Student Teaching
- June 1997- Jastro-Shields Research Award for outstanding graduate student research
- Fall 1997- Spring 1998 - Ecology Block Grant Fellowship for outstanding research proposal.

PROFESSIONAL MEMBERSHIPS

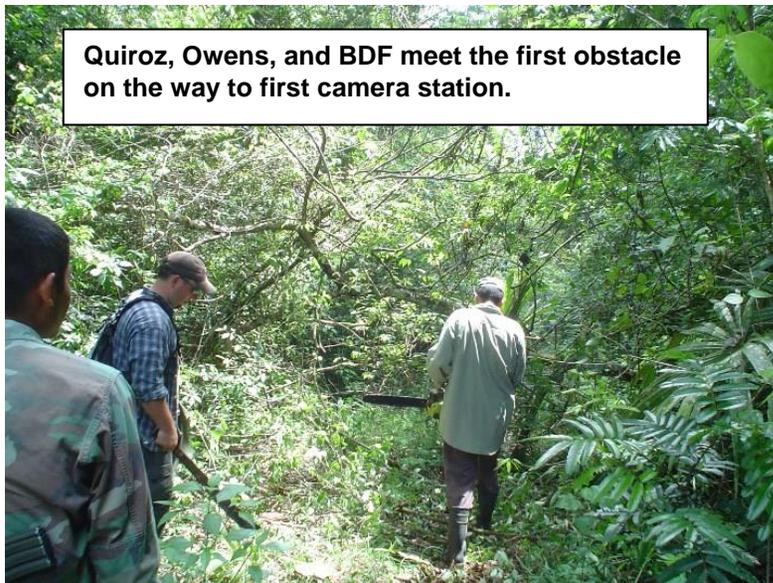
American Society of Mammalogists, American Association of Zoos and Aquariums, Eastern Cougar Advisory Board, IUCN cat specialist group, Sigma Xi, Society for Conservation Biology, The Wildlife Society



Field Technicians Victor Quiroz and Eddie Owens at the Guacamayo Bridge in June 2006. The rainy season came on hard.



Belize Defense Force (BDF) and team members attempting to reach the first camera station.



Quiroz, Owens, and BDF meet the first obstacle on the way to first camera station.



Quiroz and P.I. Marcella Kelly meet the toxic poison wood tree on the way to camera station.



Technician Tom McNamara chainsaws another log as Victor Quiroz looks on.



With no winch we had to walk out 5 km to get help for this one



McNamara pulling the winch out to free the landrover.



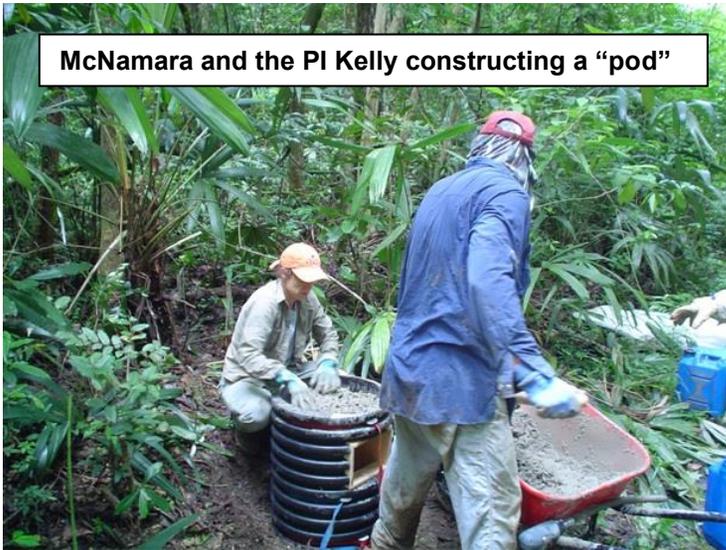
Owens pulling out the winch (again) to free the landrover.



Mud, mud, and more mud.



Technicians Jason Swenson and Owens, plus 2 unsuspecting British student volunteers who went along for a day to help out



McNamara and the PI Kelly constructing a “pod”



Owens, McNamara, and Kelly after pod completion



Owens beside camera pod before the forms have been removed.



Completed camera trapping pod with camera mounted inside.



Camera pod with stencil.



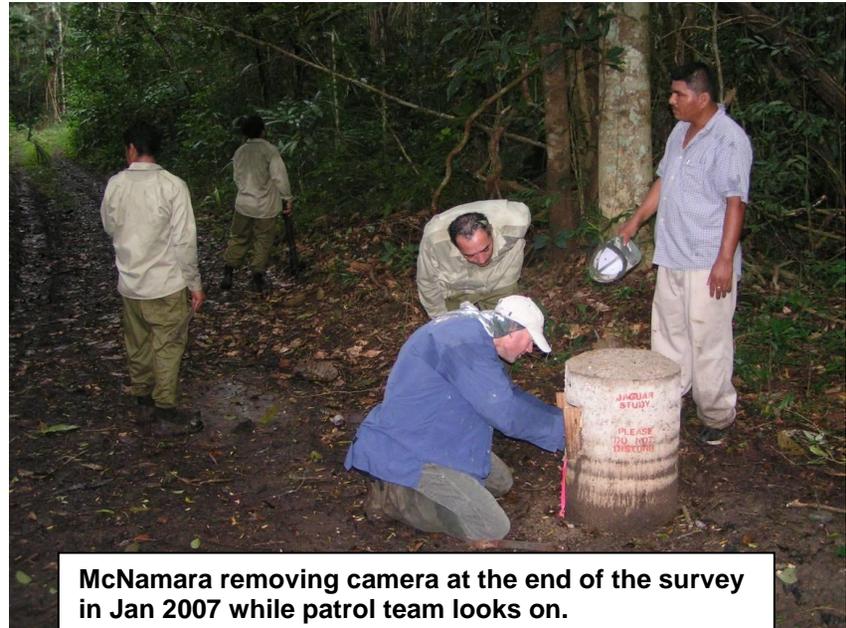
Quiroz trying to radio Forestry for help out.



Domingo Ruiz examining jaguar photos after agreeing to let us use the tractor to pull the landrover out and help us build more pods.



Derric Chan (left) of FCD and patrol team with PI examining map of the area with locations of all the camera stations.



McNamara removing camera at the end of the survey in Jan 2007 while patrol team looks on.



New jaguar with unique spot pattern



Left side of new jaguar with unique spot pattern



"Yo Kaibil, JP, Jamas Retrocedo". Translation: "I am Kaibil, never step back". Written on vandalized metal housing.



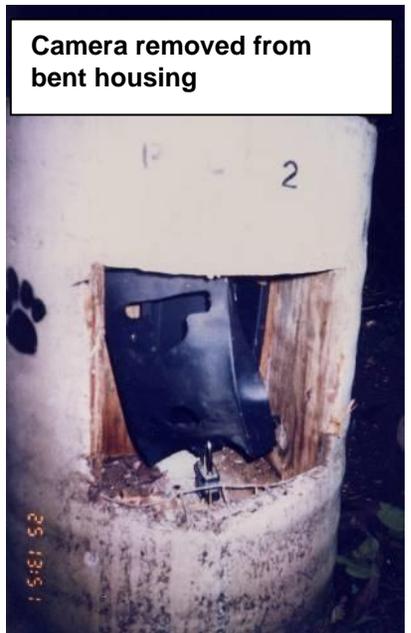
Bent metal housing pulled apart and camera removed. Padlock still intact



Camera removed from bent housing



Camera removed from bent housing



Camera removed from bent housing