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RAPHIA

Newsletter of Caño Palma Biological Station

Helen about to place a decoy egg in a nest

Canadian Organization for Tropical Education & Rainforest Conservation

Caño Palma was lead site for test of innovative technology to fight poaching of sea-turtle eggs

Helen Pheasey, who has done a lot of research at the station over the years, headed up the testing team

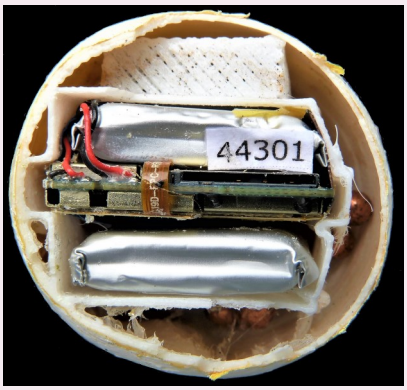
On Central American beaches, poachers destroy more than 90% of sea-turtle nests to sell the eggs into the illegal wildlife trade. This wildlife crime is devastating for endangered sea turtles. Poachers currently have the upper hand on circumventing local authorities, and little is known about the routes they use to smuggle endangered species.

To fight this trade, many individuals worked on developing a decoy egg with GPS inside. Helen Pheasey, the team lead, tested the technology to find out if it's possible to deploy a fake egg in a turtle nest, follow it when it's poached, and then trace the entire trade chain. Helen has just released the results in *Current Biology*. She has written up this summary of the study for us:

The illegal trade in wildlife threatens species survival, local country economies, and spreads disease. In Costa Rica, sea-turtle eggs are consumed as bar snacks, street food, and in the homes of coastal communities. While this is illegal, law enforcement is under-resourced and conservation efforts rely on stewardship projects with volunteer teams patrolling the beach to protect nesting female turtles. However, it is often the case that we only know a nest has been taken when we find an empty egg chamber - by which time it is too late. In response to this, a new technology has been developed by the non-governmental (cont'd on next page)

Caño Palma Lead Site in Fight Against Poaching (cont'd)

organization Paso Pacifico. The InvestEGGator is a 3-D printed decoy turtle egg designed to be deployed in turtle nests vulnerable to illegal extraction. When the nest is stolen, the decoy tracks the trafficking route enabling researchers to follow the turtle eggs. The decoys can be followed using a smartphone app.



Top - Decoy with ports open and dimple as on real egg.
Bottom - Innards including transmitter, SIM card and battery pack

This technology has only recently been developed and our team were the first to deploy the decoys. Working at Caño Palma, we field-tested the technology with two aims: First, we wanted to know if the decoys work, and second, to establish if they are safe. We undertook a safety test to ensure no harm would come to the incubating embryos if the nest was not stolen.

We deployed one decoy per clutch in green and loggerhead nests on Playa Norte. Our methods followed the protocols of the station - we waited for the turtle to go into oviposition and added our decoy at this time. The nests were triangulated in order to monitor the clutch during the incubation period. We replicated this at two projects on the Pacific coast, this time with olive ridley turtles. However, it was not possible to monitor these Pacific nests for the entire incubation period.

Overall, we found that 25% of nests were poached, of which we received 5 tracks. Two of the tracks went to properties of interest to law enforcement – a bar and a house. But the most interesting track appears to show the entire trade chain. We were able to follow this decoy 137 km from the beach of deployment, inland to what appears to be a hand-over point in the Central Valley before it moved again, terminating in a domestic property. It appears that someone was selling eggs door to door, which is consistent with our understanding of illegal trade patterns.

We excavated nests that weren't stolen and compared clutches with and without a decoy. We looked at % hatching success, number of deformities, number of eggs lost to microbial predation, and stage 1 embryo mortality. We found no significant difference between nests with and without a decoy, so conclude that placing a decoy has no negative affect on the incubating clutch.

We knew some decoys would inevitably fail and, using recovered decoys, established a malfunction rate of 32%. When we applied this to the nests that were stolen but did not produce a track, we could establish that six would have been functional but must have stayed in the local area where there's no signal. It appears therefore that most stolen clutches remain in the local area. This enhances our understanding of local trade patterns and helps us target demand-reduction campaigns.

Our research was a field trial aiming to test the decoys to establish if they work and if they are safe. The aim was not to identify individuals or secure arrests. However, now that we have proved the concept, work can continue on improving this technology and it is hoped the decoy eggs can be used as a future law-enforcement tool. The full article as it appears in *Current Biology* is available on Coterc's website at **http://www.coterc.org/uploads/1/6/1/8/16182092/curbio.16824__1_.pdf**

In this YouTube video, Helen explains the project to Reuters: **https://www.youtube.com/watch?v=sZ6uL8PMd_E&feature=youtu.be&fbclid=IwAR1MHClNov7zg3QtUjAX8FjjlXPeR9W1GixSyI7locfFHxp3UDG5eqk-6dU**

In This Issue of Raphia

Following on the successful fund-raising drive we had earlier this year, Jasmine Joy, who was at Caño Palma last year, decided that she was going to do her own fundraising. Here's Jasmine's story:

I spent May to August 2019 living and working at Caño Palma Biological Station as a Marine Turtle Intern. Reflecting back on my time spent in Costa Rica, I am grateful for the experiences I was able to have and the like-minded people I met. The station is a truly wonderful place that has deepened my appreciation for wildlife conservation and environmental protection. I wanted to help out the station during this difficult time because I appreciate the work that COTERC does to foster research and help the local community. I reached out to family and friends who had heard about my time at Caño Palma and I was able to fund-raise for the station. I'm so glad that I was able to help out, and I hope that many others continue to have amazing learning experiences. - Jasmine Joy

Jasmine raised $500. We thank her for the thought and effort.

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Past issues of *Raphia* can be accessed on our website at **http://www.coterc.org/all-resources---by-year.html**

Notes From The Station by Charlotte Foale

We are so looking forward to the return of students! We miss the bustle of interns and volunteers heading out to collect data in the forest, and to patrol the beaches. We were thrilled this month to see the return of Sam Orpin, and are hoping his arrival is the first of many. After completing a year's worth of undergraduate research with us in 2018/19, Sam will be here this time for 9 months, assisting with research and station logistics as well as helping us as we transition to a new Research Coordinator. With Sam here, we can expand our research somewhat, but we're still not able to return to a complete schedule.

With travel restrictions in place for many months now, our hardest-hit project has been Marine Turtles. Local hotels are just beginning to see a trickle of tourists, and many local residents remain unemployed as tourism is the main source of income for the area. So you might expect to see more locals heading to the beach to look for turtles and meat to feed their families. But that hasn't been our experience on Playa Norte. Poaching has definitely increased this season - the vast majority of green nests we see on the beach have been emptied of their eggs, and reports of turtles taken indicates an uptick in activity. The interesting feature of this has been that the names we hear repeatedly are the same poachers we always deal with. There aren't new faces on the beach, just the usual suspects emboldened by the lack of our patrols and consequently the decreased risk of being observed. This would have been an excellent year to deploy fake eggs on the beach to see exactly where they're heading.

Morning patrol in sunnier times

While it is always heartbreaking to see the evidence of poaching, and to receive the reports from disillusioned locals, the silver lining is the knowledge that our efforts and your efforts make a difference. It is clear from this year's increased poaching that our patrols effectively decrease the taking of eggs and live turtles. It is also crystal clear that we will need a massive effort in 2021 to bring poaching numbers back down. For us to provide the presence required, we will need multiple patrols out every night from June through the end of September, and for that we will need YOU!

If you are able to volunteer or be an intern during that period, or know someone with the fitness, attitude and the desire to make a difference, we'll need to hear from you. For more information, please get in touch with us at **station@coterc.org**

The Disc-o Bats by Doug Durno

We all know about the suction cups (called suckers) on the arms of an octopus. They use them for catching and eating prey, manipulating objects, tasting, sensing, and for moving around. However suction cups aren't found frequently among vertebrates. The northern clingfish and some frogs are examples. Among mammals, there's the rock hyrax with muscles in its rubberlike soles acting as suction cups.

Then there's a bat found at the station - Spix's disc-winged bat (*Thyroptera tricolor*). Unlike most bats that roost upside down hanging by their toenails, the five species of *Thyroptera* bats have tiny disks on their wrists and ankles that function as suction cups. These enable them to effortlessly cling to the vertical, relatively smooth inner walls of tubular leaves while they rest during the day. In fact, just one suction cup can support its entire weight.

This gives an idea of the shape and placement of the discs on the wrists.

Thyroptera's disks are plate-shaped, being slightly concave. To produce suction, the air inside the disk has to be forced out to create the necessary vacuum. But the disk is composed of cartilage. How to compress it then? Tiny, specialized muscles are attached that manipulate the disk to alter its shape for clinging and releasing.

To bolster the power of the suction, the bats have a couple of adaptations. First, the disks are always moist, lubricated by tiny sweat glands. Second, *Thyroptera* frequently lick the disk, cleaning away debris that could break the seal and allow air to enter and break the vacuum.

Now let's take a look at a Spix's bat flying into a furled leaf. As these videos show, they enter the opening at the top and make a 2-point landing (best watched with the largest expansion you can manage):

https://movie.biologists.com/video/10.1242/jeb.204024/video-2

https://movie.biologists.com/video/10.1242/jeb.204024/video-3

Interesting to note that, unlike hanging bats, *Thyroptera* roost with their heads up. This makes it easy to escape if a predator appears on the scene. When haste counts, they don't have to turn their bodies round to get in a position to fly upward and out of the leaf's opening.

However, the furled, tubular shape of the leaves they use is short-lived. These are leaves that are budding, in the process of unfurling into their mature flat, broad shape. This process takes about 24 hours. That means that *Thyroptera* are looking for new digs every day. And suitable leaves are scarce. Nonetheless, Spix's can maintain a social group of about six members for years. How do they keep together if they're moving home every day? Apparently they talk to each other. And no, they aren't using a batphone like Batman. Instead, they frequently exchange 'inquiry' calls that keep them in contact with their confreres (and consoeurs). Researchers have found that these calls have individual signatures so that group members recognize others in their social group. So, if a member finds a suitable roosting spot, it emits a 'response' call, which other group members recognize and trace to their new, temporary overnight residence.

So no, you won't be seeing disc-o bats at your favorite club. Though they may feel like dancin', their feet would just stick to the floor.

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Sticking ability in Spix's disk-winged bat, *Thyroptera tricolor*

by Daniel Riskin & M. Brock Fenton

We continue our look at papers based on research that took place at Caño Palma Biological Station

Below is an condensed version of Riskin and Fenton's paper. They were both at York University at the time: Riskin as student and Fenton as professor. Their paper originally appeared in the Canadian Journal of Zoology. You can find it on the COTERC website at:

http://www.coterc.org/all-resources---by-year.html (Scroll down to '2001') Other of their research papers from their time at the station also appear in the year 2001. Another student of Dr Fenton's, Maarten Vonhof, also has a paper based on bats from the station in the year 2002.

Most bats use claws to cling to whatever surface they normally use. Spix's disk-winged bat (*Thyroptera tricolor*) is unusual because it has disks on its wrists and ankles that allow it to stick to smooth leaves. It is one of only seven species of bats in two families that have these disk-like structures.

The purpose of our study was to investigate the ability of Spix's and 18 other species of bats that lack disks to adhere to various surfaces in order to determine the underlying mechanism, while examining its impact on their roost selection and roosting posture. Using behavioral data from live bats, we tested two hypotheses: first, that suction is the mechanism that Spix's uses for sticking; and second, that it's specialized for roosting on leaves and smooth surfaces to the exclusion of other possible roosts.

Fieldwork was conducted at Caño Palma Biological Station in 1999 during May and June. We caught most bats after dusk using mist nets. Later that year, we caught bats at a mine entrance near Perth, Ontario.

The four surfaces we used were two smooth surfaces - Lexan thermoplastic and solid sheet aluminum - and two rough surfaces - sandpaper and perforated sheet aluminum.

We confirmed that the disks of Spix's adhere to smooth surfaces by suction. They were not able to adhere to the rough surfaces. Therefore, the smooth surfaces of waxy leaves are a viable roost. Though it could not adhere to non-smooth surfaces as they moved towards vertical, we did find out by accident that they can adhere to a vertical screen by interlocking the claws of its thumbs with the holes of the screen.

As far as its head-up roosting posture, this reflects the fact that the entrance to the furled, tube-shaped leaves is at the top. Being head-up allows rapid emergence when an individual is under threat by a predator.

Disc-winged bats inside furled leaves

These photos demonstrate that the front discs are on the wrists rather than at the tips of the wings. Similarly, the rear discs are on the ankles rather than the ends of the feet.

Photo by Manuel Arias

Whatever Happened To... Featuring Alumni of Caño Palma

Dan Riskin

One of the authors of the research paper featured on Page 6 is Dan Raskin who has gone on to a quite successful career on television. At the same time, he has kept his hand in on the research side. And his field work all started at Caño Palma.

You could call Dan Riskin a rock star of zoology. As co-host of Discovery Channel Canada's *Daily Planet*, the award-winning evolutionary biologist interviewed scientists and investigated new developments on a "daily" basis. But early in his academic career, amazingly, science wasn't even on his radar - that is, until a York professor inspired him to enter the wacky and wonderful world of animal biology.

The thought of a future in science never crossed the Edmonton native's mind until his encounter with *Just Bats*, a book by York University professor and noted bat authority M. Brock Fenton. Impressed by Dr. Fenton's passion and expertise, the teenaged Dan contacted the professor asking if they could meet. Later on, after Dan had begun his studies at York, Dr. Fenton invited him to join his "bat lab", and within a few months he was catching bats at Caño Palma.

Where his York degree did lead him was to Cornell University, where Dan obtained his PhD in zoology, and then to postdoctoral work at Boston University and Brown University. His work on vampire bats attracted the attention of Daily Planet, CBC, The New York Times, and The Washington Post, and Dan began appearing on scientific TV programs like History's *Evolve* and Animal Planet's *Bedbug Apocalypse*.

Dan has also been a guest on The Dr. Oz Show, The Tonight Show with Jay Leno, and a favorite with The Late Late Show with Craig Ferguson. For a brief period, Dan taught as an assistant professor at City College of the City University of New York, but soon left the position to pursue his passion of sharing science with TV audiences.

Dan hosted *Human Nature* on Discovery Science and Animal Planet's *Monsters Inside Me*, before becoming the new face of *Daily Planet*. Since then, Dan has been educating and delighting his vast audience with in-depth explorations of the latest scientific developments from around the globe.

"My goal is to show people how much fun science is," he says. It's safe to say that's been accomplished.

Dan's now doing what Dr. Fenton did for him at York: inspiring a love of science. "I was excited to be a grad student at York," Dan says. "It was life-changing. I didn't know where it was going to lead. No one would have guessed what it would lead to in a million years."

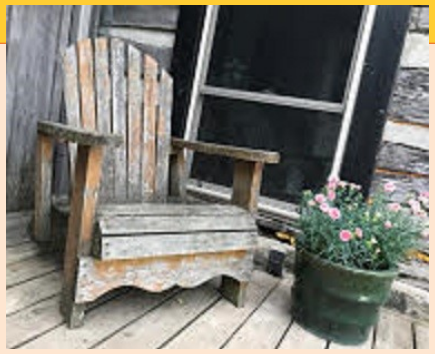
After the demise of *Daily Planet*, Dan has continued TV work with CTV. As well, he continues his research into bats at the University of Toronto as an adjunct professor of biology.

Full article at **https://www.yorku.ca/science/alumni-spotlight/dan-riskin/**

For a very entertaining video of Dan on The Late Late Show, go to:

https://youtu.be/HYDaGbOc3UY?list=SRDan%20Riskin

Notes From the Chair by Kym Snarr



The fall of 2020 in Canada is upon us! With the glorious fall yellows and oranges shining outside my cabin window, I am reflecting upon the past year and more deeply pondering about the station and its pandemic reality. During this trying period, we have continued supporting the station in carrying out its projects and maintaining its structure. Our Research Coordinator, Alessandro Franceschini, is gradually wrapping up his term at the station while we finalize a replacement for him. He has been able to work nearly independently with the support of Manuel Arias, our project team leader, and Charlotte, our station manager, who make up our in-country long-term staff extraordinaire!

Alessandro has been working with the long-term mammal data, evaluating the feasibility of examining carnivore interactions in the presence or absence of an apex predator. It's exciting to see how our long-term data has been used. When I came onto the Board over a decade ago, I began to examine the research that was being carried out at the station. Many of the projects over the years were excellent, delivering important data about various taxa in the region. As a testament to this work, you can find all of the reports and publications on our website - **http://www.coterc.org/all-resources---by-year.html** While all research publications and reports are not captured there, you can see that the station, since its inception, has provided opportunities through experiential learning for established researchers, young researchers, and those who just want to learn about the research process!

At that time, I felt we needed to put into place a number of long-term monitoring projects (LTMP) as a way of understanding population trends over time. This would build a rich database that researchers coming to the station could work with. The Board agreed and so there has been a slow build-up of LTMPs that are low cost and easily learned. Coupled with having stable, capable staff, COTERC has helped create a rich database on multiple taxa to help paint a picture of the sought-after trends, an important hallmark for conservation work.

As pointed out by Doug Durno in this and other *Raphia* newsletters, the station has been a learning ground for young researchers, many of whom have been launched into various careers – such as academia, active conservation, field research, and government positions across the globe. Through this examination of former Caño Palmers and their ties to the station, we can see the invaluable lessons they have learned about themselves – documenting personal and professional growth from their time at the station. As we head into 2021 and our 30th anniversary, we will continue to think about the station's accomplishments along with all those who have dwelled and studied there, and been part of the building of the station community. I look forward to hearing all of these stories and the continued building of a rich database!

Stay safe and be well,

Dr. Kymberley Snarr

The Virtues of Viruses by Doug Durno

Viruses are bad. We all know that. I mean just look at the coronavirus. Then there's all the other diseases that viruses cause like influenza, pneumonia, colds, HIV, herpes, hepatitis, SARS, rabies, and on and on. So, maybe you're thinking it would be wonderful if viruses could be made to disappear. Not so fast. As epidemiologist Tony Goldberg put it, "If all viruses suddenly disappeared, the world would be a wonderful place for about a day and a half, and then we'd all die. All the essential things viruses do in the world far outweigh the bad things."

Well, if viruses are doing such awesome things for us, why haven't we heard about them? Mainly because scientists prioritize research into remedies for the various viral diseases. It wasn't until the 1990s that research on the positive side of viruses really got going. But, before we look at some of those benefits, let's learn a little about viruses.

Viruses live to infect. They infect to reproduce. That's it.

So, it won't surprise you that viruses are simple things. They're just genetic material (either RNA or DNA) contained in a protein shell, with some, like Covid-19, having a fatty membrane enveloping them.

Since they lack a cellular structure, viruses can't use cell division to reproduce. Instead, they inject themselves into a host cell – be it animal, plant, fungus or bacteria. Once inside, the virus releases its genetic material, which hijacks its host cell and commands it to assemble copies of the virus. Hundreds of new viruses can be made pretty quickly each time this happens. That's why the coronavirus can spread so rapidly through the body.

Viruses are found almost everywhere on Earth. Way smaller than bacteria, they're abundant to say the least. Oceanographer Jennifer Brum said that if you took a swig of seawater while swimming in the ocean, you'd have 200 million viruses in your mouth. And those viruses are going to be infecting the 20 million bacteria in that same mouthful. Not to worry though, most viruses and bacteria are harmless to humans.

Now let's get a sampling of the beneficial things viruses do:

- **Stayin' Alive** - We all know that we depend on plants for our oxygen. Except that's only half true. Plants supply only about 50%. The other 50% comes from the oceans, specifically from microscopic phytoplankton including cyanobacteria. These microbes produce energy through photosynthesis, releasing oxygen as a waste product. Now what if these phytoplankton were to die off for some reason. Well, without the oxygen they produce, we'd soon die off as well. In actuality, phytoplankton are often in danger due to a scarcity of phosphorus, an element required by all life. And it's viruses that save them. When viruses kill the bacteria that host them, phosphorus is released, which phytoplankton can then ingest, ensuring they're able to keep pumping out that oxygen we require. Viruses kill up to 50% of all oceanic bacteria – every day.
- **Arrested Development** – Certain viruses lessen the impact of AIDS and Ebola. As well, researchers have found that the herpes virus makes mice less susceptible to bubonic plague and listeria. They feel it would do the same with humans. In fact, they think that these immune benefits are part of a symbiotic relationship between humans and the herpes virus.
- **Kill the Winner = Biodiversity** – Sometimes a species, be it bacteria or insect, (cont'd on next page)

The Virtues of Viruses (cont'd)

will be too successful, outcompeting others in its ecosystem. Logically, this should lead to the 'winner' forcing its competitors out. Fortunately, viruses multiply right along with their 'winner' host, keeping it in check. Thus, space has been kept open for biodiversity to be maintained. Perhaps with tongue in cheek, some describe the present coronavirus as a 'kill the winner' event.

- **Holy Cow** – Scientists now believe that it's not only bacteria, but also viruses, that help cows (and other ruminants) break down cellulose from the grasses they eat into simpler sugars. This allows the cows to survive on an almost indigestible diet.
- **Evolution** – As mentioned, viruses reproduce by injecting genetic instructions into a host cell. If that host cell happens to be a germline cell – that is, an egg or sperm – some of the virus' genetic code may become integrated into the genome of the germline and be passed down to future generations. In fact, 8% of the human genome is composed of viral sequences though almost all of that code has become inactive. Nonetheless, viral genes are sometimes beneficial. For example, one viral gene played a role in the development of the embryo. It enables nutrient and waste exchange between the developing embryo and the maternal blood supply. Another viral gene played a role in birth timing.
- **Antibiotic Resistance** – The more we use antibiotics, the greater the chance that bacteria will develop resistance. One alternative is the bioengineering of viruses to target a specific infection. As someone put it, they're "like little microscopic guided missiles that go in and blow up the cells we don't want". This way, unlike with antibiotics, the beneficial bacteria in our systems are not killed off. When used against cancer cells, there are no side effects.

The list could go on. But the point is made: viruses help to maintain life, balance and diversity on Earth. So, although we always have to be wary, we should appreciate viruses for benefits they provide.

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In this electron-microscope image of the coronavirus, note how much smaller viruses (green) are compared to the bacterium (orange).

La Crisálida (Part 2) by Mitch Harrow

When Marilyn Cole founded Caño Palma in 1991, she wanted to build a community-conservation project that would support the station area with jobs, funds, and education. In the Summer issue, we saw the many problems that delayed her dream. We resume in 1995 as Marilyn starts to see signs of progress.

Fortune Began to Smile (Fall 1995 – July 1996)

Finally fortune began to smile. First, a new station manager, Daryl Loth, a biologist both willing and capable of running the project, came on board. By the fall of 1995, phase 1 was underway, overseen by Tom Mason, a director of COTERC.

The Butterfly Garden was originally set to be located at the station. But in 1996 an agreement was reached to build it in the village of Tortuguero on donated land. It was thought this would be more convenient for tourism, plus it would be easily accessible by schoolkids and the local community. The supplies to build the garden were purchased and stored at CPBS awaiting final approval. However, to build in Tortuguero, new permits were needed through the municipality of Pococi. ACTO (the Tortuguero Conservation Area), who were overseeing conservation in the region, didn't respond. Strangely, the Zoological Society of San Diego had just opened a new butterfly conservatory, Butterfly World, in the Barra del Colorado Wildlife Refuge. Despite similar values and objectives, Marilyn got no answer while Butterfly World was allowed to go ahead.

The frustration expressed by Marilyn and all who were involved was palpable since the goal was less about the butterflies and more about the income it would bring to an economically stressed community. It would also "…draw attention to the fact that Canadians are interested and involved with the problems of deforestation and sustainable development in Costa Rica". Finally, in July 1996, all documents were in place to satisfy MINAE, ACTO, the municipality of Pococi, and the village of Tortuguero.

Building the Dream (August 1996 – September 2001)

Things started to move quickly. On September 18th, Daryl was given the go-ahead to hire a local contractor with the hope that the project would be completed by Christmas. Daryl suggested that the building be built with concrete since termites are a problem, to which Marilyn agreed.

Daryl and Pat Opay were trained by Spirogyra Butterfly Garden who provided a certified biologist and export papers to obtain butterfly specimens. With this project being as much sociological as ecological, Daryl said:

> "Apart from being a project that offered an ecologically sustainable alternative for land use in a sensitive ecosystem, it also really appealed to me as a project that could empower women who were raising their children at home. It was work they could do in their own gardens with a small amount of space."

By October 1998, the first report from project manager Robin James stated that butterflies were beginning to emerge at the newly christened La Crisálida. Robin said the (cont'd on next page)

La Crisálida (Conclusion)

blue morpho (*Morpho peleides)* was a big draw for tourists. The visitor center was soon finished, complete with lights for evening. The project was also exporting the tiger longwing *(Heliconius hecale)*. The official opening of La Crisálida was August 4th, 2000 and it was fully operational by September 2001.

News from La Crisálida (Winter 2001)

With the Farm up and running, funds were being donated to the local high school to help build a basketball court.

But the adventure was about to come to an end. Though moderately successful, the village government asked to have the building converted into a daycare centre, which was deemed to be a greater necessity. The Costa Rican Ministry of Health had funds available to pay for staff so this was an easy decision to make. Daryl noted that CIDA, where the grant money originated, was fine with the change since the structures would continue to serve the community. As Daryl said: "The daycare, which doubled as a nutrition centre for underprivileged children, allowed mothers of young children to get part time jobs, thus empowering them".

To this day the building stands as evidence of over a decade of dedication by all involved. It's a testament to vision, perseverance and passion. Even though the farm no longer exists, the idea of community conservation is brilliant and should be emulated where possible.

Daryl Loth (below) with Pat Opay. Daryl was station manager from 1994 to 1996. Pat, who worked with Daryl to develop this project, preceded Daryl as manager.

Mitch Harrow, who put together this story, studied environmental anthropology with Dr Snarr, eventually gaining a Masters in Environmental Studies. With 20 years experience in conflict resolution and education, he's spent the past 5 years helping communities design innovative spaces. Mitch wove together this story of Caño Palma's butterfly sanctuary from many emails, letters, articles and historical archives, which served only to endear him more to the history of the station and the perseverance of its friends.

Daryl Loth still lives in the area. He runs a B&B called Casa Marbella in Tortuguero where he's been quite active in the community for many years.

Why Prothonotary by Doug Durno

In the bird world, English names can get a little obscure in groupings that have a lot of similar-looking species. Like the hepatic tanager. Or the piratic flycatcher. And don't get started on hummingbirds with their trainbearers, sunangels, coquettes and on and on.

Which leads to the question of how the prothonotary warbler got its name. One clue is the word's last half - 'notary'. From that, we can guess a prothonotary is some sort of court official. In fact, the word may have originated in the Roman Empire - but it could have been in Greece. Court officials in both held that title. Yet the title also appears in the Byzantine Empire and the Catholic Church. But what's all this got to do with the warbler, you impatiently ask?

It seems that at some point officials of one of those jurisdictions wore golden robes in the discharge of their duties. Nobody seems to know exactly where or when. They just know golden robes equate to the golden plumage that prothonotary warblers wear.

Which all leads to another question: Wouldn't it have been simpler to go with the prothonotary's former name - the golden swamp warbler?

After all, it's strikingly gold - and, if you want to see one, you'll have to go looking for it in the swamps and mangroves and marshes where it hangs out. At Caño Palma, it's found around channel edges and sometimes ventures out onto a snagged branch. In Canada, the only reliable place to find a prothonotary is the north shore of Lake Erie, in particular the swamps of Long Point. There, in the dimness of forested wetlands, its golden hue shines as it flits from branch to branch above the water.

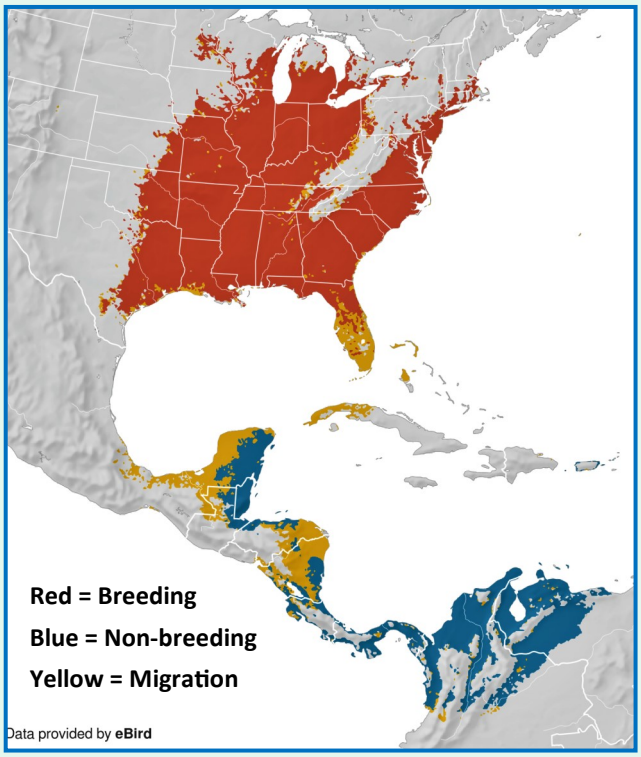
Besides its name, the prothonotary is also noteworthy because of its nesting choice. All other North American warblers (except Lucy's) construct a cup-shaped nest in a tree or on the ground. The prothonotary nests in tree cavities, often using an old downy woodpecker excavation.

Swamps and marshes are usually good spots to satisfy their insect diet and feed their young. Plus predators have a harder time reaching them if they nest over water - though that can be a safety hazard for fledglings that aren't yet good flyers. However young prothonotaries seem to be good swimmers as they've (cont'd on next age)

Why Prothonotary (cont'd)

been observed splashing their way back to dry land.

But, with our habit of developing swamps and other watery habitats, prothonotary numbers have declined about 42% over the last 55 years. We also like to cut down dead trees, which are the easiest to hollow out for a nest. The best way to help prothonotaries is to restore forested wetland. Or you could install nest boxes on their breeding grounds. At Long Point, they're removing roads and channeling streams.



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Would Richard Nixon have become president without help from the prothonotary warbler?

In 1948, U.S. State Department employee Alger Hiss was accused of being a spy for the Soviet Union. He had been fingered by the admitted Soviet spy Whitaker Chambers though Hiss claimed he'd never met Chambers. Richard Nixon was an ambitious young congressman, chairing a House subcommittee that was privately questioning Chambers to verify that he really knew Hiss. When asked if Hiss had any hobbies. Chambers said Hiss was an amateur ornithologist who had excitedly told him about spotting a rare prothonotary warbler on the Potomac River. In a hearing, Nixon set a trap by asking Hiss if he had any hobbies to which Hiss replied birdwatching. And had he ever seen a prothonotary warbler? "I have, right here on the Potomac", Hiss answered. The committee now was convinced Hiss knew Chambers and was a Soviet spy. Partly due to the hearing, Nixon became a nationally recognized figure and Eisenhower eventually asked him to be his vice-presidential candidate in 1952.

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Research Coordinator's Report by Alessandro Franceschini

With Alessandro the only remaining person residing at the station, surveys have been greatly limited. Here's a summary of how Alessandro and Manuel have been faring with the different surveys:

Large Mammals - Only Caño Palma and Cerro transects
Tent-making Bats - Only in Caño Palma and the Cerro
Otters - Totally cancelled
Plant Phenology - Not affected
Macaws - Only Caño Palma surveyed, once a week
Shorebirds - Totally cancelled
Marine Turtle Tagging and Monitoring - Totally cancelled
Snake Morphology - Totally cancelled
Caiman Survey - Totally cancelled

Alessandro

July **Weather** - Rainfall was quite low. This resulted in a mean canal depth that was 20% lower than last July. Consequently, the station experienced no flooding, an unusual situation for this time of year.

Large Mammal Monitoring - This month, 13 different mammal species were detected, a comparatively high number. This can likely be attributed to an increased sampling effort. The total number of detections (347) was also high because several herds of white-lipped peccary were found. As well, all 3 species of primates were encountered.

Macaws - At 55, great green macaws had one of the highest averages per survey yet recorded.

Mesocarnivore Guild Analysis - With some assistance from Dr Roberta Fulthorpe, Alessandro is progressing on this project. Here's a brief explanation of it:

> Caño Palma has been monitoring mammal populations in the area by conducting surveys of tracks and scat on designated trails for many, many years. Alessandro has been analyzing these valuable survey records with a view to elucidating interspecies interactions in the "**mesocarnivore guild**". This term refers to the group of small to medium-size forest-dwelling carnivores in our area - the ocelots, tayras, common opossums and Virginia opossums - that feed on similar prey. A variety of interactions are possible between these guild members - avoidance, positive associations or flat-out indifference (neutrality!). By examining the records of their presence and absence, Alessandro can begin to understand the degree to which their populations can coexist in their environment while facing the problem of competing for limited space and similar resources. Furthermore, he can gauge the impact of the apex predator - the jaguar - on the presence of all those guild members.

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Research Coordinator's Report (cont'd)

August There have been no changes to the surveys that Alessandro and Manuel are working on (as summarized above).

Weather - With rainfall at a relatively low level, mean canal depth decreased even further from July's levels. This means that the probability of flooding will remain quite low at least until December.

Large Mammal Monitoring - Again all 3 species of primates were observed. In total, 14 species were observed this month, one more than last month. The additional sighting was an ocelot.

Tent-making bats - On the Caño Palma trail, quite a number of active tents were found. The most numerous bat species was Thomas' fruit-eating bat. A total of 49 adults and 16 juveniles were uncovered (2.8 individuals per tent). Due to the presence of the juveniles, we were able to distinguish four separate family groups of this species. We also observed 5 adult and 2 common tent-making bats (3.5 per tent). For the Jamaican fruit-eating bat, we counted 15 individuals (2.5 per tent).

Neotropical river otters - After speaking with two friends of Emily Khazan's who are expert on caimans and river otters, Alessandro changed the focus of his research. His aim now is to collect fecal matter, which can then be analyzed in regard to their diet. It might then be possible to combine his dataset with Diego's dataset from Guatemala. For this reason, Alessandro is creating distribution maps for otters and caimans divided by years, age and type of encounter.


Photo by Manuel Arias

September Again no changes to surveys.

Tent-making bats - The relatively large community of the **Jamaican fruit-eating bat** was mostly undetected this month, with a decrease in observed individuals from 13 to just 3. This means that this population is much bigger than what we see, suggesting that they have access to many more roosting sites than what we can keep track of OR that they have a huge home range. So, we expect that the number of individuals of this species detected month by month will remain relatively low with occasional big increases.

Macaws - For two days, we participated with the Macaw Recovery Network for their annual macaw count. Surveys took place at Caño Palma and San Francisco. There was a huge gap between the number of audio observations and visual observations in San Francisco. Thus, these partial results highlight the importance of maintaining multiple sites for our long-term macaw monitoring.

Poaching - On the beach, Alessandro is coming across many dead turtles. As well, eggs are being taken from almost all nests. This highlights the importance of our presence on Playa Norte. Without our patrols being out there, the poachers have little reason to be deterred in their activities.

Personnel - Sam Orpin (England) has returned to the station from England.

Canadian Organization for Tropical Education & Rainforest Conservation

We welcome any comments or suggestions from our members to ensure you feel involved. If you have an idea for an article, or better yet, would like to write one yourself - if you have a photo or two that you think we could use - if you have a suggestion for improving Raphia, please send along to us at directoratlarge4@coterc.org

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