

RAPHIA

Newsletter of Caño Palma Biological Station

Thanks to You, We've Pulled Through



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Even for a quarterly publication like *Raphia*, things can change fast. This issue was to feature the mass Spring migration of birds through Central America and their spread across the North American continent.

Obviously though, it's the even quicker spread of COVID-19 across the continents and how it has affected the station, both research-wise and financially, that has to be our main focus. You'll find those messages from Charlotte and Kym on the next couple of pages.

Personally, I'm amazed at the flood of support Caño Palma has received via our fundraising campaign. We have to thank you all for this extraordinary response, which hopefully will carry us through this exceptional period when travel is restricted and no money is coming in. As well, while I'm sure we all realized the bond so many of us have with the station, it was great to see so many heartfelt comments expressing your feelings.

Now to the birds. Their migration is topical since the *Raphia* distribution date coincides with the passage of millions of birds through Central America on their way north. But, when I say millions, what I really mean is billions. (See story at bottom of Page 9)

As of mid-April, the migrators have started to reach the southern USA. While the odd early bird has made it to Canada, it won't be till mid-May that many species, particularly the tiny warblers, cross the U.S. border, heading for the boreal forests of Canada that are the breeding grounds for so many. DD

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Notes from the Station by Charlotte Foale

I write hoping that everyone who reads this is safe and holding up under what are strange times. With some awesome people on base, and a great line-up of interns and RA's for the season, we had to sharply change our focus when Covid-19 started to make its presence known around the world. We went from training and data collection, to evacuating interns and preparing the Station for self-isolation. Getting in supplies, unsure as to how many would remain here, with travel restrictions changing every day. We set about planning how to keep the station afloat with no income, while working for as long as possible towards our research, conservation and education goals.

While we started to plan the different phases toward the eventual worst-case scenario of station closure, Board members put together a GoFundMe page, unsure if people would be in a position to help.

We have been overwhelmed by the response of former interns and volunteers, long-time supporters and complete strangers who have taken the time to donate and to share our information. We couldn't have anticipated your generosity and kindness, and cannot adequately express the gratitude we feel.

So here we are, Alessandro and Charlie, our Research Coordinators, with Jim, our lone stranded intern...and of course, Manuel, Emanuel and me!



Alessandro



Charlie



Jim



Manuel

While the adjustment was more emotionally taxing than changes we've had to make when we flood, or when we had to evacuate for Hurricane Otto, we're settling into a routine, completing the surveys that we can, and getting to jobs we don't normally have time to address.

At present, we're restricted from entering Tortuguero NP and the Cerro. However we are able to continue with all Caño Palma surveys, including the river-based otters, caimans and plant phenology, as well as snakes and mammals, and of course macaws. We continue to collect data for interns who had to leave - on tent-making bats and beach erosion, and while night patrol is impossible at the moment, morning census lets us keep an eye on turtle activity. We'd already decided to triangulate nests on morning census this year, so hopefully we'll have some nests to excavate from leatherback season. With increased erosion, nesting has been extremely limited, so it would have been a tough start to the season even without current limitations.

With less time at the Station, I've finally been able to spend more time in our community library, organizing and preparing resources, as well as setting some homework for kids who can pass by the fence to collect it.

Circumstances are far from ideal for anyone right now, but we're feeling incredibly lucky to be isolated in such an incredible place, and to be able to continue working. This wouldn't be possible without your support. We can't wait until the Station is again filled with the voices of biologists young and old – we miss you, and can't wait to have you home!

Thanks from the Chair by Kym Snarr

Dear Fellow Caño Palmers,

It's with a joyful heart that I send out a resounding thank you to all of those in the CPBS/COTERC community who generously gave to help fund the continued work of the station during the pandemic! I have been astounded by your generosity on the [GoFundMe page](#) reaching over \$10,600 Cdn at the time of my writing, and it means that the security of the station has been restored. Thank you. You were already generous of your time and energy - whether you had been on the Board and/or carried out work at the station. Each of us in this community have given what we can with the skill sets we already had or those we gained during our involvement. Many of you shared your story. Many asked your own friends and family to donate to support the station's important work. Your generous response has made it possible for the station to remain open, and continue to carry out its projects as it pursues its mission of education, conservation, and research!

The moneys raised will be used directly for station operations and projects – meeting the basic bills including staff and necessary project materials. We run 11 long-term monitoring projects – an incredible feat for the station!! Funding comes mainly from interns and researchers who come to the station; and from fundraising events or grants procured by the COTERC Board. All Board members are volunteers and give of their time, often contributing directly through purchases of equipment or financial donations.

The station is a special place for many. I was there for two weeks in January and February, gathering site-service details for updating maintenance and projects, and evaluating repairs to be done in the future. It was incredible to reconnect with the station – it felt like coming home and being back physically in my community. I overlapped with students from Vanier College, Montreal, incoming applied-science students carrying out their projects, and all staff – new and old. My husband, Art Shannon, and I brought down a number of donations to help meet station needs including: laser range finders to help improve mammal and otter surveys; PIT tags for snake survey; forestry equipment for re-establishing forest plots; donated kitchen materials for improving camp life; and some new strings for the old guitar that's been banging around the station for years. To all who donated these items, thank you very much! We could not do what we do without your support!

There are great difficulties in the running of a biological station in a remote location in lowland tropical forest. Along with all of our triumphs, we face challenges each year - floods, tree falls, intern cancellations, staffing handovers, medical issues, poaching traumas, vandalism to project setups, and bringing new Board members up to speed. Each year, COTERC and CPBS continue to work with these challenges to keep the station a safe, viable research facility where international, national, and locals (cont'd on Page 6)



Like a Snake Outgrowing Its Skin by Michelle Sone



Waking to the sounds of howler monkeys and other local fauna is not something I imagined I'd ever be doing when I began working on my Masters degree in Environmental Science in the fall of 2018. Yet here I was deep in the rainforest of Costa Rica.

I had never done field work before or even been to a tropical country. So arrival at the station was somewhat of a culture shock. Bathing was done in outdoor showers. Due to the risk of clogging, toilet paper had to be thrown into a waste bin instead of being flushed. Combined with the heat and humidity, it was all a bit overwhelming. So we explored the station, met the globally diverse staff and volunteers, and were given a rundown of dos and don'ts. But the thought of seeing the diversity in the rainforest had me more excited.

My goal was to complete a three-month internship at Caño Palma. I and another UTSC student were to be mixed-taxa interns so we would be helping with multiple surveys, though Charlotte did her best to consider your interests.

As we had arrived near the end of leatherback breeding season, and would still be here for hawksbill and green-turtle breeding season, we were trained to do night patrol and morning census, which involved looking for nesting sea turtles at night and then checking their nests in the morning for signs of poaching, predation or hatchlings. In time though, I spent most of my days looking for the great green and scarlet macaws, riding a boat at night along the canal in search of spectacled caimans, and helping measure snakes we caught – my favourite task (as at right). Of course, we also took part in stuff like data entry, meal preparation and general tasks around the station.

Living and working at Cano Palma was rough at times. It would be a lie to say that I didn't have doubts I could make it through to the end. Even my favourite surveys, such as macaws, could be difficult at times. Most surveys required you to wake up before the sun rose just so you could eat and prepare yourself for the day. Many surveys also had you walking through some



Working with snake

tough terrain, the hardest being the beach, which I can attest is harder than it sounds in the soft sand. Surveys were rarely cancelled due to weather. Rain or shine we had to be out there, and while rain did bring with it a cool breeze, cool winds become unbearable when you're drenched head to toe. Only the most extreme circumstances, such as flooding, could stop most surveys, which did happen at one point.

However, all of it becomes worth it when it comes to seeing firsthand the biodiversity. I got to hold a leatherback hatchling when we conducted an excavation – a process where we dug up nests post-hatching to check their status to see if any eggs or hatchlings remained. I got to measure a 2m-long fer-de-lance, a highly venomous snake – safely mind you, with its head in a tube. I was able to see massive flocks of macaws, both green and red; and every size caiman from small hatchlings to large adults. And those (cont'd on next page)

Thanks from the Chair (cont'd from Page 4)

can gain invaluable lessons about themselves as well as find personal and professional growth.

As we head towards our 30th year, we continue to develop and support the station's various projects. In Canada, COTERC is working towards gaining back our Charitable Status with the CRA. It is a paper-chase and we are confident we will accomplish this task successfully. We are also heading towards our annual AGM, which we will be holding virtually. Look at www.coterc.com where details will be posted. For anyone who wishes to work on our Board, please contact me directly at chair@coterc.org to discuss. We have had former research coordinators and student interns join us on the Board, which helps to bring further insight and excellent direction to the Board.

As I continue in isolation during the pandemic, I reflect on the international nature of the community of Caño Palma Biological Station. Each person I encounter at the station adds another unique piece to the very fabric of the station and its important work. Each one who comes and goes takes with them their own unique story. I am privileged to be part of this community and helping to lead the Board into and past the station's 30th year of operation!

Stay safe and be well,
Dr. Kimberley Snarr



More donations

Like a Snake Outgrowing (cont'd from Page 5)

are just the species I saw when we conducted surveys.

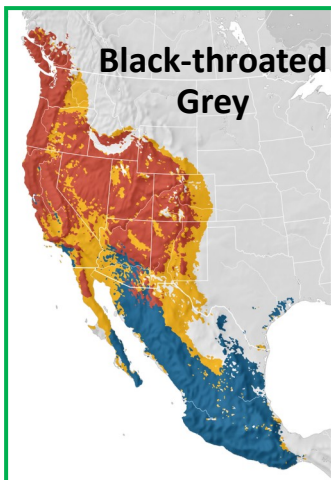
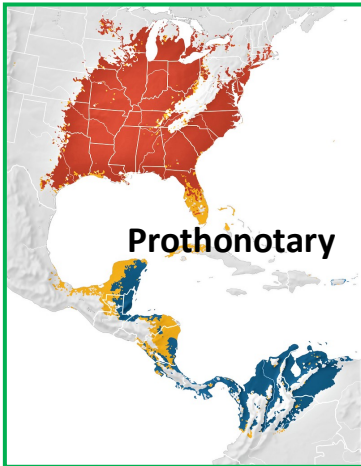
I can't even list every experience I had and species I saw without writing several pages. The local flora and fauna is so diverse that you would have to stay longer than three months just to see maybe half the species. It really shows how important protecting the rainforest is. To think that some species I saw could be extinct in my lifetime is startling. The great green macaw, for example, is endangered and while potentially growing in numbers, it still could be extirpated from the area. Or worse, gone altogether.

Caño Palma reinforced for me, and I'm sure anyone else who goes there, just how important the rainforest and biodiversity are. It's not easy. But if I can do it, so can you.



Why Warblers Migrate by Doug Durno

Red = Breeding grounds
 Yellow = Migratory flyways
 Blue = Wintering grounds



Of the 51 warbler species found in North America, about 44 of them make lengthy migrations. As the maps show, warblers (and other migrators) have evolved varying migration patterns and breeding-territory sizes in order that they and their offspring will have the greatest chance of surviving.

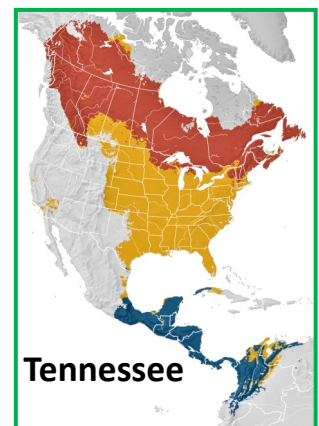
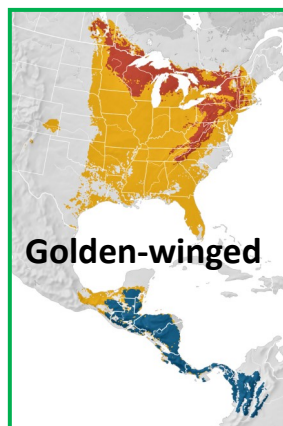
Why do small birds like warblers make these harrowing journeys? After all, it's one, two, three thousand miles or more from South or Central America. Such distances put their tiny bodies (most warblers weigh between 85 and 140 g – 3 to 5 oz) under enormous stresses. Along the way, they have to contend with storms and predators and heat exhaustion. Wouldn't they have a lower mortality rate if they just stayed in the tropics?

The answer is no. In their northern breeding grounds, it's estimated that twice the number of hatchlings are born than if the warblers remained in the tropics to procreate. There, if no birds migrated, fierce competition for food amongst the greater numbers would result in many adults and hatchlings starving to death. Nesting sites would be at a premium too.

Warblers are insectivores. And if there's one thing they can count on when they move north in springtime, it's a bounty of bugs. As well, the boreal forest provides plenty of trees to nest in. So breeding warblers in the boreal will have sufficient food and space to raise their young. And that's why they come north -- to produce the next generation of their species.

In addition, the Northern Hemisphere provides longer days. At its summer solstice, that means 50% more time to hunt bugs and feed the brood than they'd get in equatorial areas.

Or, as someone put it, in spring warblers move from "from an area that has decreasing or low resources to an area that has abundant or high resources". Conversely, as insect numbers dwindle in the north in late summer and fall, adults and juveniles travel south to start the cycle again.



SPRING

2020

Taking the Boring Out of Boreal

by Doug Durno

What are forests? Simply put, they're a whole lot of trees standing around together, with their branches mingling up there in the canopy in direct contravention of proper social-distancing practices.

What good are forests? For humans apparently, their most important purpose is providing the wood pulp to make toilet paper. But for many animals, as we all learned in primary school, forests provide their basic needs: food, water, shelter and space. And they pump out the oxygen we all need to live.

But for you the conservation-minded, boreal forests offer a couple of other quite consequential functions: carbon storage and migratory-bird habitat.

Before we get to that, let's get to know the boreal forest a bit better. Known as the taiga in Eurasia, this type of forest circles the globe north of the 50th parallel. Given that the Canadian border is at the 49th parallel west of Ontario and the boreal's north to south width is over 1000 km, that means much of Canada is covered by the boreal. In fact, it covers about 60% of Canada's land area, stretching right across the country from the Yukon to Newfoundland.

Conifers like spruce are the most widespread tree types.

And a considerable amount of its 3 million square kilometers is untouched by roads, urbanization or development.

Why untouched? Because so much of it is uninhabitable. Enormous wetlands dominate the boreal. Two, the Hudson Bay Lowland and the Mackenzie River basin, are among the largest wetlands in the world.

In the climate-change era, the boreal is especially

critical because of its immense storage capacity for carbon. It's estimated that the Canadian boreal forest contains 12% of Earth's land-based carbon. In fact, it stores more than twice as much carbon per hectare as tropical forests. Surprisingly, though the boreal's trees are important for carbon storage, it's the soils, wetlands, peatlands and permafrost that hold most of the carbon.

Finally, let's relate all this to this edition's main topic, migratory birds. Research has found that 325 bird species – or about half the species regularly found in the USA and Canada – rely on the boreal for their survival. Between 1 to 2 billion migratory birds flock there each spring to nest and raise their young over the course of summer. Once the young are ready to fly, 3 to 3.5 billion adults and young return to wherever it is they spend the winter. Up to 1 billion of these end up in the United States. The rest continue down to Mexico, the Caribbean, Central America and South

America. Besides warblers, other songbirds relying on the boreal are finches and sparrows. Many waterfowl and shorebirds as well as raptors and owls also make the boreal their summer home.



One last thing – The North American boreal is also the Earth's largest reserve of fresh water. This nearly pristine water was left there when glaciers melted at the end of the last Ice Age, leaving the area with 1.5 to 2 million lakes.

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The Canada Warbler by Doug Durno

Unlike other geographically named warblers mentioned in the article on Page 10, a look at the Canada warbler range map shows that it's well named. About 85% of this species summer (in red) in Canada, mostly in the boreal forest. Caño Palma is a good place to look for the Canada warbler during migration.

As a look at the photos shows, another name for this species is necklaced warbler. In contrast to the male's bold necklace (top), the female's is faint (bottom).



Though it breeds mainly in Canada, that doesn't mean it's particularly fond of the country. Compared to other warblers that make it there, the Canada warbler arrives late and leaves early. It's a long flight -- about 5000 kilometers each way -- so even the short duration must be worth it.

As the map shows, the Canada warbler mainly winters in northern South America, from Venezuela into Colombia and down through the Andes to Peru. Unfortunately,



forests in this region have been decimated, which is likely the main reason this warbler's numbers have declined by over 70%. On these wintering grounds, about 90% of the land has been cleared. Besides using the trees for fuel, the land is used to raise cattle and grow crops like coffee and coca. It doesn't help the Canada warbler's survival chances (or other birds for that matter) that the coca is destroyed by spraying with nonselective herbicides.

In the Canada warbler's breeding range, Breeding Bird Survey data show an ongoing population decline of 3.2% per year. Its habitat has been reduced by forest fragmentation, over-browsing of the understory by deer, acid rain, and the spread of the woolly adelgid (an aphid-like bug that mainly kills fir and hemlock trees).

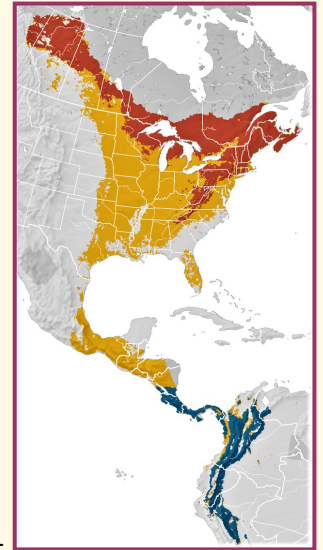
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How Many Birds Migrate?

Researchers have developed a method that uses weather radar to estimate the number of birds migrating in the Americas. It involves complicated algorithms that can measure differences in biomass as seen by the radar.

They've found that birds entering the U.S. in the spring number about 3.5 billion. After breeding, the number leaving the U.S. in the fall is 4.7 billion – or an increase of 1.2 billion.

For Canada, the estimated number of birds arriving in spring from the U.S. or points further south is about 2.6 billion birds. On the return trip in the fall, 4 billion cross the Canada/U.S. border. That's an increase of 1.4 billion birds. One reason for Canada's higher increase is that most birds crossing into the U.S. in spring don't stop there. They continue on to Canada. So Canada gets more arrivals and thus more hatchlings.

[https://www.nature.com/articles/s41559-018-0666-4?](https://www.nature.com/articles/s41559-018-0666-4?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+natecoleval%2Frss%2Fcurrent+%28Nature+Ecology+%26+Evolution%29)

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A Tale of the Misnamed Warblers

by Doug Durno

In 1812, a guy named Alexander Wilson found a dead warbler in Connecticut. Naturally he called it the Connecticut warbler.

He also named the Tennessee, Nashville and Cape May warblers based on where he found them. So what's wrong with the names Wilson gave these species? Well, how was he to know that the Connecticut warbler hardly ever gets to that state. Tennessee, famed for the Nashville warbler and Tennessee warbler, seldom sees either of those species except when they fly over during migration. And the Cape May warbler was described in 1812 and then wasn't seen in New Jersey for another 100 years. I mean, in the early 1800s, how was Wilson supposed to know about migration? (Besides, Connecticut is a mixed-up place anyway. It's called the Nutmeg State. Nutmeg for crying out loud. When did a nutmeg tree ever grow in Connecticut? It's tropical. And Connecticut sure ain't tropical.)

Nowadays, Classification Committees for South America and North America (SACC and NACC) make most of the decisions on the names of birds and their family, genus, etc. They have all sorts of info with which to make informed decisions.

Yet Wilson sure tried to be informed. A poor schoolteacher, he decided birds would be his thing. In 1804, he set off to illustrate all the birds of North America. After much collecting and drawing of specimens, he published his first volume of *American Ornithology* in 1808. Nine volumes later, his work included 268 species, of which 26 were described for the first time. To accomplish all this, he must have been a workaholic since, according to one account, he died in 1813 of "dysentery, overwork, and chronic poverty".

Wilson is honored with several birds named after him, including Wilson's plover, Wilson's storm-petrel, Wilson's phalarope, Wilson's snipe, and of course the one most of us know, Wilson's warbler.

Reportedly, Wilson's books inspired Audubon to work on his illustrated *The Birds of North America*. It's no wonder that Wilson is referred to as the Father of American Ornithology.



Armed to the Teeth by David Kondo

David always wanted to be a zookeeper and, to that end, studied zoology at the University of Toronto before applying to the Toronto Zoo. The Zoo's medical screening surprised David with the news of a vertebral anomaly that disqualified him for Zoo employment. Although he turned to a new career, David always involved animals in his personal life, training dogs and keeping snakes for over 40 years while also presenting children's educational programs about snakes. Retirement has recently allowed him to join the Toronto Zoo... as a volunteer.



Many people consider snakes to be significantly more dangerous than other types of animals. Venom factors into that viewpoint, but less than 25% of all snake species are dangerously venomous to humans. Still, people are often afraid of snakes even if they know the snake is non-venomous. Since snakes don't



have claws, their weaponry is their teeth. So let's see if snake teeth are a cause for concern.

To better understand the teeth, let's first examine the skull. A snake's skull is quite different from a human skull. The snake skull has more moving parts and joints. For instance, humans have a one-piece lower jawbone whereas snakes have separate lower dentary bones that enable independent alternate movement of the left and right sides of the jaw, allowing a snake to "walk" its jaws over its food. Snake skulls have bones and joints that allow movement (called kinesis) within the skull. With a kinetic skull and elastic tendons, ligaments and skin, the snake can stretch its mouth horizontally and vertically to swallow prey that's larger in diameter than its own body. A snake's jaws have flexibility and elasticity, but they do not dislocate.

A snake's upper jaw structure is fascinating because the bones are not fused as in the human skull. In humans, the palatine and pterygoid bones are integrated as part of the skull's hard palate. In snakes, these bones aren't a component of the braincase. They can move independently and they can support teeth! Humans have a row of teeth on the upper jaw and a row on the lower jaw. Snakes, with their kinetic skulls, have **six rows of teeth**: a row each on the two lower jaw sides, a row each on the two upper jaw sides, and a row each on the two sides of the "roof of the mouth" bones (as in picture at right).

Snakes are built to eat their prey whole. Their teeth aren't required to cut or chew (cont'd on next page)



Armed to the Teeth (cont'd)

food, only to penetrate and/or hold their prey – so their teeth are undifferentiated for the most part (unlike humans with our incisors, canines, molars, etc.). Snake teeth are continually replaced when worn or lost so the root structure is not as entrenched as it is in mammals.

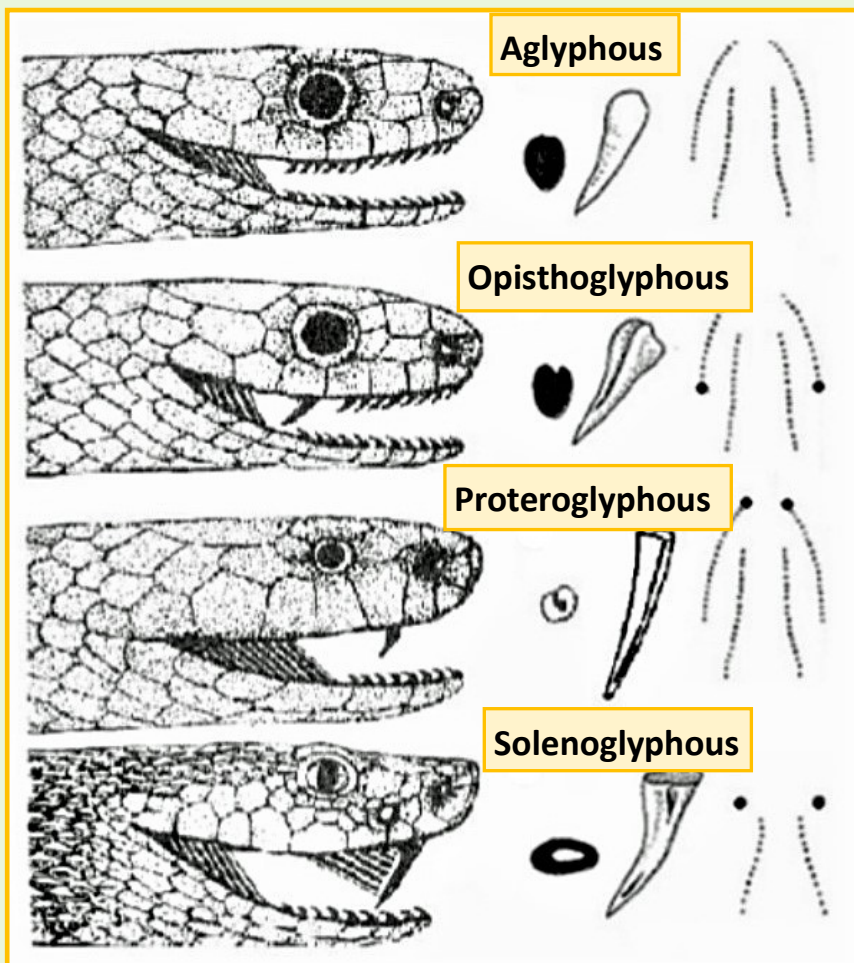
Related to its method of subduing prey, a snake may belong to one of four dentition groups. **From left to right, the diagram shows: teeth in a profile view, a cross-section of a tooth diameter, a tooth image, and an upper-jaw bite pattern.**

Aglyphous – normal teeth for holding prey, no venom delivery, e.g. boa, milk-snake.

Opisthogyphous – grooved rear-fangs direct venom flow, e.g. hognose, boom-slang.

Proterogyphous – grooved front-fangs are non-moving and direct venom flow reasonably well, e.g. cobra, krait.

Solenogyphous – large hollow front-fangs swing into place and inject venom efficiently, e.g. viper, rattlesnake.



Venom is delivered when muscles surrounding the venom gland contract, pushing the venom through a duct to the tooth. Biting behavior varies from species to species, although vipers usually employ a quick-strike injection delivery while rear-fang snakes usually bite and hold and/or chew, allowing venom to flow along the dental grooves. In general, rear-fang snakes tend to be less dangerous to humans than front-fang snakes. Their venom is less toxic and their tooth placement makes it harder for them to envenomate humans. But there are deadly exceptions like the rear-fanged boomslang (which has potent venom and can open its mouth 170 degrees).

So, are snake teeth really a cause for fear? If they're associated with a venom gland, then definitely yes! However, if those teeth belong to a non-venomous snake, there's not a lot to worry about. A defensive bite is usually quick and doesn't hurt nearly as much as people anticipate. (Personally, I've been bitten by budgies and hamsters and I think they hurt more than a small to medium snake.) Besides, if you don't bother the snake, it's not going to bother you!

Research Coordinator's Report — Mammals by Alessandro Franceschini

December **Flooding** – December featured a period of heavy rain so that flooding hampered our ability to do surveys for about 14 days. Despite the difficulties, we managed to work together as a team and to make everything (ourselves included) flood-ready. During those days we carried out all the surveys we could. Inevitably though, otters and mammals had to be drastically reduced. We were also hampered by the limited number of personnel.

Mammal survey – This is one of the surveys that had to be cut back. Archie Carr Wildlife Refuge wasn't surveyed at all this month. White-lipped peccaries were the most detected species both around Caño Palma and in Tortuguero National Park. Domestic dogs were the most-sighted mammal on the Cerro.

Plant phenology - It was only completed on the canal. Flooding made the forest transect impracticable for survey work.

January **Mammal survey** – With a greater number of people on base, we were able to complete all surveys at least once. In fact, we did 13 mammal surveys, averaging 45 detections per survey. Though this average was way down from December (76), that month's numbers were high because two big herds of peccaries were found. Agoutis, peccaries and red brocket deer were the most frequently detected mammals. Other highlights included the sightings of a tamandua and greater grison.

ACER - This is a long-term project carried out by students from Vanier College in Montreal. The purpose is to track changes in forest diversity over time. The students also have to research a specific topic and write an essay on it.



Greater Grison



Northern Tamandua

Emily Derby – The poison red dart frog in regard to mimicry and aposematic coloration.

Annie Dunn – Conservation efforts for the great green macaw, focusing on which policies have been adopted, and why the great greens are so abundant in the Tortuguero area.

Thyvia Thurunavukkarosee - The effect of tourism on the three species of monkey in the Tortuguero area.

Massimo Campbell – Smuggling in Costa Rica, with a focus on bugs.

February **Precipitation** – We entered the dry season with rain decreasing 44% compared to January. Still, it was a 237% increase from last February, a particularly dry month. Along with an increased number of interns and volunteers, we were able to double our survey total compared to January.

Tent-making bat survey – Four surveys were completed and again, as has been the case recently, there wasn't much activity. One new tent was spotted and one Thomas's fruit-eating bat was found. Most tents were unoccupied.

Otter survey – Nine otters were actually spotted this month, an unusually high number. 73 scat sites were recorded. (cont'd on next page)

Mammal Report (cont'd)

Aeres University of Applied Sciences (Hogeschool) – We welcomed four students from this university located in Dronten in central Netherlands. They were:

Jim Takahashi and **Bo van der Eerden** were doing mixed-taxa internships.

Rick van der Haar is investigating the susceptibility of the coastal environment to erosion on Playa Norte. His research will also examine the protective effect that various plant species provide.

Rebecca Huistra will be researching how different plant species respond to flooding.

The research of both Rick and Rebecca could have a strong impact on the local community given the importance of both coastal erosion (a lot of houses are located very near the coast) and flooding, assuming that these phenomena will increase in magnitude as a consequence of climate change.

ACER – Dr Kym Snarr, chair of COTERC, accompanied by her husband Art Shannon, visited the station and collaborated with us on developing a better systematic protocol for work on the ACER plots. Dr Snarr also assisted with other aspects of the station's organization and data.

Joshua Brown – With his amazing passion for and knowledge of birds, Josh was really helpful in transmitting his passion to other interns. Very early on, he took the lead on bird surveys, showing great bird ID skills.

Personal – I took an online course in **distance sampling**, which involves a range of methods to estimate the density of biological populations, and the abundance of inanimate objects like birds' nests or animal burrows. Assuming it's properly designed, this type of sampling can improve the precision of estimates and reduce bias. Field methods can be improved along with the quality and informativeness of collected data. In working with Tortuguero National Park, they've offered us data on boat traffic. This should help us to improve our analysis of how human disturbance affects sites like otter transects and caiman habitat. As well, I've been in contact with Stephanny Arroyo, the founder of Coastal Jaguar Conservation, to discuss possible cooperation in studying carnivores and eventually sharing data on our transects and her camera trapping.

March

As COVID-19 disrupted the planet, personnel on base mostly decided to return home. Only Charlie Pinson (herp research coordinator), Jim Takahashi (intern) and I remained on base.

Obviously, this affected our projects. While some have carried on as before, others have been totally cancelled. And others are being carried out in a limited number of transects.

ACER – Initial results are in from this year's survey completed by students from Vanier College. We can observe a clear difference in the average Diameter at Breast Height (DBH) of the trees between our two plots. Trees in the Caño Palma plot have an average of 17.2 cm compared to the much smaller average in the Cerro plot of 13.5 cm.

Also, the number of trees is very different. In the Caño Palma plot, the total number of trees is 899, which is about 20% lower than in the Cerro (1129 trees).

These numbers seem to indicate a generally younger and thicker forest in the Cerro when compared to Caño Palma. It might be due to the fact that the Caño Palma plot has several subplots that suffer flooding for most of the year, which results in a lower tree density. In the Cerro, trees are not suffering from flooding, but they can have their own problems. First, the soil and the steepness make landslides more frequent. Second, their exposure to winds is greater, increasing the probability of trees falling down. These two phenomena could create open space in the Cerro forest more frequently than in Caño Palma, and this opening in the forest will produce a younger community characterized by denser vegetation.

Research Coordinator's Report — Herpetology by Charlie Pinson

January **Marine Turtles** – The last nest of the 2019 season was excavated on the 28th of December. The next monthly report won't be till the 2020 nesting season, which typically occurs in early March.

February **Marine turtle tagging and monitoring program** – The first leatherback emerged and nested on February 28th. However permits had not yet been issued so patrols couldn't be started. This leatherback was noted incidentally.

Caiman survey – On four caiman surveys, a total of 143 caiman were observed. The decreased rain brought considerably lower than average water levels in the canal. This could explain the higher numbers of caiman since lower water levels effectively bottleneck the caimans into a smaller area, making them easier to spot.

Nesting leatherbacks - With the severe erosion on Playa Norte over the last two months, there are concerns about the amount of suitable nesting habitat available. As well, with rough seas, we're concerned about the safety of patrol teams walking the beach at night. We're going to have to play it by ear, possibly having to postpone night patrols until waters calm.

March As Alessandro has mentioned, we had to cut back on a lot of surveys because so many of the people who were here had to leave the country due to COVID-19. One was Ylva Poirier of HAS University in the Netherlands whose project was to concentrate on tent-making bats, and she made a quite interesting discovery in the short time she was here. Whereas we have not been finding many tent-making bats lately on the areas surveyed, Ylva chose a spot with an incomparable density of them. Despite the fact that Ylva had to leave, we've decided that we will investigate why this area has so many tent-making bats.

Marine-Turtle Tagging and Monitoring Program - Many constraints have been placed on us and the work we are able to do. Due to governmental efforts to stop the spread of the COVID-19, beaches have been closed to the public. While our permits remain valid, we've had to reduce our survey effort to a weekly morning census. However we've combined the census with a study seeking to quantify erosion on Playa Norte.

Erosion study – It was developed because we've observed a much higher-than-average rate of erosion for the last several months. The waves now reach the vegetation along the vast majority of the beach, meaning there is far less suitable nesting habitat for the sea turtles. This is of particular concern for the leatherbacks, which have a preference for laying in open sections of beach.

Only 2 turtle activities were recorded on Playa Norte in March, both of which involved poaching. It's likely that far more nests were laid. However any evidence of them was washed away by the waves before we were able to record them.

This month we also received a letter from Cynthia Lageux at the Archie Carr Centre for Sea Turtle Research, informing us that two of our tags had been recovered from Nicaragua. Unfortunately, this means that those two turtles are now dead. But the information is useful for deducing migration routes and interseasonal habitats as well as estimating mortality rates in sea-turtle fisheries.

Snake Morphology – Quite a month for snakes. In fact, it was a record. We captured 34 snakes of 7 species. Allen's coral snake was by far the most frequently captured snake at 17 or half of all snakes.

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