

# Rufford Small Grants Conference Proceedings

**Title:** RSG Conference Galapagos, Ecuador 2019 - Science for the conservation of the Eastern Tropical Pacific Region



**Image:** The conference participants outside of the Charles Darwin Research Station on the last day of the conference.

### Date:

21 – 25 January 2019

### Venue:

The conference was co-hosted by the two leading research and conservation institutions in the Galapagos Islands. The conference opening and days 2 and 3 took place at the Galapagos Science Center, a joint research station operated by the Universidad San Francisco de Quito and the University of North Carolina at Chapel Hill, on San Cristobal Island. Conference days 4 and 5 took place at the Charles Darwin Research Station on Santa Cruz Island.

### Country:

Host country: Ecuador. Invited countries of the Eastern Tropical Pacific Region: Perú, Ecuador, Colombia, Panamá, Costa Rica

### Organiser:

Organising committee Robert W. Lamb, Charles Darwin Station and Brown University - robert\_lamb@brown.edu Maximilian Hirschfeld, Galapagos Science Center and James Cook University - maxh@enphocus.net Javier Oña, Proyecto Cetacea Ecuador and Universidad San Francisco de Quito - ecujavier10@gmail.com

### Summary of conference:

The Rufford Conference for the Tropical Eastern Pacific exceeded all possible expectations. With 32 participants, we had the perfect number to be able to engage in high-level discussion on a variety of issues and share experiences from a variety of study systems, while keeping it small enough that we all got to know each other on a first-name basis and keep discussions manageable (not to mention the moderate number of participants allowed us to stay within the conference budget). The topics covered ranged everywhere from jaguars, to sea turtles, to jaguars that actually eat sea turtles (in Costa Rica, jaguars hunt turtles that have come onto the beach to nest, dragging the helpless turtles away from the beach to kill and eat them in the forest). We also took advantage of the conference venue to learn from the experiences of scientists at both host venues and from managers of the Galapagos National Park in a series of expert panel discussions. We also shared mutual skill sets in communication, writing, and photography workshops. Each participant thus took home a new community of like-minded conservationists and scientists, new skill sets for effective conservation and communication, and new conceptual paradigms to apply to conservation challenges in each country. We feel proud to have provided a space for this interchange of ideas and experiences, and feel that we have passed the baton for others to organize conferences with similar positive outcomes in the future.



**Image:** This picture of Victor Montalvo (Costa Rica) presenting his work with jaguars (with a Galapagos tortoise looking on from the Charles Darwin Foundation banner) epitomizes the cross-linkages between Tropical Eastern Pacific countries, ecosystems, and species that formed the foundation of the Rufford Conference - Galapagos.

### What were the main objectives of the RSG Conference?

### State briefly what the RSG Conference aimed to achieve.

The RSG Conference Galapagos gathered emerging conservation leaders of the Eastern Tropical Pacific Region to:

- 1. Exchange knowledge created through Rufford-funded projects
- 2. Host a series of workshops designed to enhance professional skills for conservation science and project leadership

3. Host a series of workshops involving local stakeholders to identify the main challenges to nature conservation in the region and to formulate potential solutions

This conference built on the overarching goal of bringing together conservation-oriented researchers from Ecuador and other Eastern Tropical Pacific countries to exchange current knowledge on conservation science in the region. We brought together scientists and institutions dedicated to biodiversity conservation and managing authorities to identify gaps in knowledge and to develop new approaches to tackling current and future conservation challenges.

Specifically, we provided a platform for regional conservation scientists and local institutions to debate and integrate concepts of the connectivity of marine and terrestrial biodiversity in the Eastern Tropical Pacific countries. One facet of this integration was through the presentation of the results of Rufford-funded projects and their application to management. Each Ruffordfunded participant discussed their study system/organism, the ecological findings and conservation outcomes of their work, the challenges they faced in their work, and how the Rufford Foundation aided in tackling those challenges.

The setting of the conference also provided a context for regional Rufford grant recipients to learn from the successes and challenges of managing an emblematic world heritage site and conservation hotspot, the Galapagos Islands, incorporating local authorities such as the Galapagos National Park and the Ecuadorian Ministry of Environment. These authorities joined expert scientists at both the FCD and GSC to provide a series of targeted workshops for the conference participants to enhance their skills in applying research to real world conservation issues and communicating their work in written and audio-visual media.

Finally, we are currently in the early stages of developing a manuscript for publication in a scientific journal focusing on the key findings of the Rufford-funded conservation projects of the Eastern Tropical Pacific countries and the outcomes of the conference. This will collate recommendations for management practices and integrative conservation approaches developed during the conference as a permanent and tangible product.

### What was the impact of the RSG Conference?

• Were there examples of where Rufford Funding has enabled disproportionately large and tangible conservation impacts to be delivered?

The magnitude of conservation impacts by Rufford-funded projects is enormous. Tangible outcomes from the projects presented at this conference include changing the regulations for cetacean-viewing tourism in Panama and Chile, producing novel methods for tracking the origin of shark fins sold in markets in Peru (a method now used globally), detecting the level of genetic mixture between geographically distinct populations on both land and at sea, assessing human-wildlife encounters and assessing the impacts of these encounters for both parties, assessing the ecological impacts of deforestation and land-use change, and quantifying the spatial range of adult animals to estimate the area required for conservation of the species. In each case where a tangible impact on conservation outcomes was apparent, there was a strong human dimension to the project. This took on many forms including working with managers of protected areas, training and building self-management capacity in local communities, providing conservation workshops, and engaging with school children. These strategies obviously vary in their expected outcomes, but holistically it is apparent that Rufford funding in the region is generating a society that is more aware of and active in the mitigation of conservation challenges.

# • Were there examples of locally developed approaches to biodiversity management?

One interesting outcome of the conference was the different ways in which each grant recipient approached both the biological and human elements of their projects. There was clearly a deeply profound investment by each person in the place they work and the people they work with. Researchers spend months or years living and working in remote habitats, where permits are challenging to acquire, and where social issues conflict with conservation priorities. By engaging at this level, it was clear that the conference participants felt a personal attachment to the focus of their work. However, there was a wide range of perspectives taken on the biological systems of interest. Many people take an ecosystem perspective, such as mangrove habitats for important fisheries species, forest patch sizes needed for bird and mammal abundance, and insect diversity as a function of land use change. This view of the ecological community as a single functional unit with both biological and environmental characteristics seems effective for atrisk ecosystems with multi-species conservation objectives. Other projects focused on key species with critical information gaps for effective conservation measures, such as jaguars and sharks. These species require targeted strategies for conservation that include providing essential habitat, estimating overall health and susceptibility to disease, and minimizing negative interactions with humans. However these species-oriented projects often resulted in protections afforded to large areas of land and sea as critical habitat, which in turn can support the recovery of non-target species

as well. Regardless of the approach, both threatened species and they habitats they live in receive a benefit.

# • Were there examples of how has Rufford support helped early career conservationists achieve their goals?

The conference participants came from a variety of backgrounds and were at different stages of their careers. However, almost all Rufford-funded work took place at the stage of recipients carrying out their Master's or PhD thesis research. Unproven scientists and conservation ideas in general often have difficulty getting off the ground. Hearing the stories of each attendee's career path made it evident that the Rufford Foundation not only establishes lasting conservation outcomes, but has also helps in professional development of the grant recipients.

• Were there examples of how Rufford funding has helped support work on species and ecosystems that are traditionally difficult to fundraise for?

The conference showcased conservation research on a broad range of ecosystems and species. The typically easier species to fund conservation for are "charismatic mega-fauna", large animals that attract public interest. These also tend to be mammals, which usually attract more empathy from humans. Some of the more unorthodox projects included native bee diversity in Colombia, non-shark reef fishes in the Galapagos, and moths in Costa Rica.

# • Were there examples of how Rufford grants have provided seed funding to build capacity, identify conservation needs and develop replicable models for future projects?

The support of the Rufford Foundation, in almost all (if not all) cases presented at the conference, empowered small-scale projects where base funding is a major challenge. In particular, unproven scientists and unproven systems or methods can be very difficult to fund. Initial funding from the Rufford Foundation provides the grantees with enough support to test risky ideas and raise basic, fundamental information about under-studied systems. Repeated funding facilitates building upon that initial baseline of information to establish holistic long-term projects. Through the tiered grant renewal system, grantees can build their professional career while building ecological knowledge and sustainable conservation outcomes.

• Were there examples of how Rufford funding has helped train a future generation of conservationists?

We were overwhelmed by the environment of mutual support, respect, professionalism, and optimism harboured by the group of Rufford grant recipients who attended the conference. It is clear that not only has the Rufford Foundation supported important conservation and research projects, it has also helped produce a regional community of high-caliber scientists and conservationists. Two clear examples of the importance of Rufford funding for professional development are Pedro Mendez Carvajal of Panama, and Ximena Velez-Zuazo, of Peru. Pedro started his talk by showing a picture of his younger self from his first ever visit to Coiba Island to catalogue primate diversity. When he first got there Coiba was still a penal colony used by the Panamanian government, and was both a difficult place to work and a completely under-studied system. This island boasts one of the highest densities of large mammals in the country, including several endemic species. Since his first visit, Pedro has gone on to start his own foundation for the research and conservation of the island's iconic mammals, and has set the tone for future research on their behaviour and ecology. Ximena was in a similar early stage in her career when she first received a Rufford grant to study the effects of high seas fisheries on Peruvian sharks. Ximena is now a professor in her own right, and has developed genetic tools to quickly, cheaply, and accurately detect the species identity and geographical origin of shark fins that can be applied in fishing ports where often the fin is the only part left of the shark that can be used for identification. Ximena started an entire research program on shark fisheries in Peru and has provided tools that are being used worldwide to stem the trade in shark fins.

#### • Were there tangible conservation outcomes from the conference itself?

In addition to the typical conference style in which each grant recipient presented on their respective projects, we organized a series of trainings and workshops to build regional capacity for addressing conservation challenges. We held one workshop on how to improve the integration of scientific research and ecological knowledge into conservation actions. We met with two representatives from the Galapagos National Park, Danny Rueda (director of park ecosystems) and Jenifer Suarez (marine technical advisor) and two scientists from the Charles Darwin Station, Inti Keith (director of marine invasive species research) and Maria Jose Barragan (science coordinator) to discuss their experience in an expert panel discussion. This proved to be one of the most enriching experiences of the conference, as the park authorities gave their candid perspective on the role that science and scientists play in their decision making. One of the main issues highlighted during this workshop was a lack of effective communication on several levels. The specific conclusions of the expert panel were:

1. There is a lack of networking and communication among scientists. Improving communication and collaboration among scientists, even within countries and disciplines, can improve the impact of conservation projects by increasing knowledge exchange and transfer of essential skills. 2. There is a mismatch between the information provided by scientists/project leaders and the information needed by policy makers/managing authorities. The concept of what scientific information is most needed to manage and preserve natural resources differs widely between the ones that generate the information and the ones that want to make use of it. A proposed solution is to plan strategic meetings at the early stages of conservation research projects to better understand the needs of policy makers and managing authorities by researchers and project leaders and vice versa. Subsequent meetings and scientific reports may be much more effective based on the established common ground. 3. There is a barrier between scientists/project leaders and the general public and end users of the natural resources that need conservation management. Scientists often use technical language and are cautious about the scope of their conclusions, which does not engender strong confidence in the general public regarding the potential effectiveness of proposed conservation measures. Improving communication of scientific information, conservation project progress and outcomes with the general public and end users can help sustain the support for and the acceptance of policy and management decisions.

We also gave trainings in wildlife photography/communication and technical scientific writing. The photography workshop gave basic tips on how to compose a photograph, rules for lighting, focal point, and dynamism, and how to tell a story with a single picture. Tips for photography were followed by an inspiring presentation by Daniela Vilema, the communications manager for the Charles Darwin Station, who shared her training from National Geographic on how to optimize public communication of science. Everyone was taking notes furiously during both presentations. We also provided a short workshop on technical writing for scientific peer-reviewed journals. This workshop covered basic writing style tips, strategies for selecting a journal, composition of a paper, and guidelines for ethical authorship. Again, many participants voiced their enthusiasm at the professional development opportunities provided beyond the project presentation component of the conference.

• Were there examples of where Rufford grantees have published important biodiversity information?

Two areas in which Rufford-funded projects have provided important and novel biodiversity information are in cataloguing diversity in under-studied, often hard to access locations, and novel findings on human-wildlife interactions and how they can be mitigated. One example concerns Dalia's work regarding the dolphins of Bocas del Toro in Panama. Dalia found that whereas the bottlenose dolphins of the entire Caribbean region are essentially intermixed, the population living in Bocas del Toro bay is resident and isolated, with little to no mixing with other groups. It is unclear what drives this genetic isolation, but the implications are that a) this population requires a unique conservation strategy and b) population declines in the bay due to forced removal for dolphinariums or excessive tourism traffic will not easily recover due to the lack of influx of new individuals from other populations. This requires management specific to the local population that takes into account its vulnerability to human impacts. Another example involves that of a widespread skin disease outbreak in Galapagos reef fishes due to an extreme El Nino event. Since El Nino increases local sea surface temperature by >2 °C, this event served as a fast-forward of ecological dynamics in a warmer world, and underscores the need for long-term monitoring to detect these uncommon, unpredictable wildlife emergencies. Ninon Meyer also accesses difficult, remote locations of the Panama tropical forests (Darien region) to survey populations of endangered large mammals such as tapir. She used their distribution in these relatively undisturbed forests to project where their natural range should be in more developed areas of the country.

### Issues raised and any recommendations made

# Were there any other issues specifically raised by attendees? Also, were there any recommendations that arose as a result of the conference?

Three of the main issues raised by conference participants were:

- Political instability is antagonistic to implementing management strategies by governmental managing authorities.

- A lack of continuous funding for conservation projects, which is needed to achieve tangible conservation outcomes that are sustainable in the long term.

- The new Rufford Foundation policy of requiring grant recipients to receive funds through a sponsoring institution, such as research station or university, presents a major barrier to effective conservation work. Most institutions charge a substantial overhead, which can run from 20 – 60% of the total grant. Since Rufford grant are already fairly small for the conservation aims most recipients are targeting, this could seriously undermine the viability of these projects. It was suggested that if this regulation needs be instated, perhaps an effective compromise would be to require the institutional affiliation for the first grant, but to allow successive grants to be funded directly to individuals. At this stage there should be enough repoire established to justify the greater risk of funding an individual, while the unencumbered funding system would significantly improve the rate of success of funded projects.

We also administered an exit survey of participants, with questions aimed at producing recommendations for how to improve the outcomes of both Rufford-funded projects and for Rufford-funded conferences. We summarize the results below.

### Recommendations for future Rufford projects:

- Consider the people that are linked to the natural resource you are trying to conserve. Humans are a principal factor acting on natural resources but are also key to their conservation.

- Involve the local community to maximize research outputs and induce change

- Plan to communicate and share your research with non-scientific audiences

- Envision a long-term strategy for your project and empower others to become conservation leaders

- Include collaborators from other disciplines into projects to improve the educational components and the communication of the project

- Collaborate with other mangers and authorities to improve the application of research to management decisions.

#### Recommendations for future Rufford conferences:

- Invite more speakers from other disciplines such as social science and education to improve participants skills in these areas

- Include science communication workshops or activities

- Provide more room for active discussions

- Host conference in areas that are important examples for conservation where participants can learn from positive and potentially negative examples.

- Invite the public and local institutions to attend the conference to share the results of Rufford projects with the local community. For example, if we inform people from Ecuador about what is happening in Peru, Costa Rica, Panama, they may realize that conservation is a global issue and similar problems are faced by many countries.

- Add a workshop on grant writing

### List of participants, conference schedule and abstracts

Presenter	Age	Rufford year(s)	Country	Study system
Yasuni Chiriboga	24	2016	Ecuador	Sharks
Ximena Velez Zuazo	45	2011	Perú	Sharks
Víctor Montalvo Guadamuz	32	2011	Costa Rica	Jaguars
Diana P. Ochoa Castro	NA	2016	Ecuador	Sea lions
Héctor Emilio Ramírez	35	2017	Colombia	Bat diversity
Chaves Alexandra Cardona (coautor de Hector Chavez)	25	2017	Colombia	Rodent diversity
Ninon Meyer	31	2015-2017	Panamá	Tapir, pecary
Mayra Galindo	32	2015	Colombia	Bee diversity
M. Camila Estrada-Flórez	31	2012, 2014	Colombia	Bird diversity
Laura M. Vargas	30	2017	Colombia	Jaguars
Shaleyla Kelez	41	2008	Perú	Sea turtles
Cindy Meliza Hurtado	31	2012, 2019	Perú	Mammal diversity
Hansel Herrera	NA	2015	Costa Rica	Wild cats
Hansel Herrera	29	2015	Costa Rica	Jaguars
Esteban Guevara	37	2014-2016	Ecuador	Hummingbirds
Adriana Gonzalez Pestana	32	2018	Perú	Hammerhead
Mónica Gonzalez	57	2015	Ecuador	shark Cappuchin monkey
Ana María García-Cegarra	33	2015, 2017	Perú	Hump-back whale
Alvaro Gonzalo García-	31	2016	Perú	Mammal diversity
Olaechea				·
Nohelia Esperanza Farías Curtidor	34	2016-2017	Colombia	Dolphins
Elpis J. Chávez Calderón	31	2015	Costa Rica	Bull shark
Gustavo A. Castellanos- Galindo	38	2007, 2009, 2014	Colombia	Mangrove habitats
Andrea Borbón	25	2017	Colombia	Andean bear
Dalia Barragán-Barrera	34	2012, 14, 16, 18	Colombia	Bottlenose dolphin
Alexandra María Ávila Leoro	32	2011	Ecuador	Grouper (fish)
Montes-Fontalvo Jenilee	32	2017	Colombia	Moth diversity
Pedro Mendez Carvajal	44	2017	Panama	Monkey diversity
Diana Pazmiño	30	NA	Ecuador	Sharks
Aura Alonso Rodriguez	31	2013	Costa Rica	Butterfly diversity
Javier Oña	32	2012, 2014, 2016	Ecuador	Hump-back whale
Maximilian Hirschfeld	34	2012, 2016, 2018	Ecuador	Bullhead shark
Robert Lamb	32	2011, 2013, 2015	Ecuador	Fish diversity

Table: List of conference participants and project details



#### The IV Rufford Small Grant Conference South America

#### Science for the conservation of the Eastern Tropical Pacific Region

#### **Conference Schedule**

#### Monday, 21 January 2019

Schedule	Activity	Location
14:00 - 15:00	Arrival on San Cristóbal Island and accommodation of the participants	USFQ
16:00 - 17:00	Welcome by Carmen Guzmán (sub-director GSC) and Andrés Pazmiño (operations director of USFQ Galapagos) General introduction by the organizing committee and presentation of the conference program	GSC Conference Room
17:00 - 18:30	Walk around town and getting to know the island	
19:00	Dinner	Mockingbird

#### Tuesday, 22 January 2019

Schedule	Activity	Location
07:00 - 08:00	Breakfast	USFQ
08:00 - 10:00	Talks by Rufford grantees (6)	GSC Conference Room
10:00 - 11:00	Coffee break and poster session	GSC Foyer
11:00 - 13:00	Talks by Rufford grantees (6)	GSC Conference Room
13:00 - 15:00	Lunch	Mockingbird
15:00 - 17:00	Workshop: Scientific writing	GSC Conference Room
17:00 - 19:00	Free	
19:00	Dinner	Mockingbird

### Wednesday, 23 January 2019

Schedule	Activity	Location
07:00 - 08:00	Breakfast	GAIAS
08:00 - 10:00	Talks by Rufford grantees (6)	GSC Conference Room
10:00 - 11:00	Coffee break and poster session	GSC Foyer

11:00 - 12:00	Talks by Rufford grantees (3)	GSC Conference Room
12:00 - 13:30	Workshop and expert discussion: Connectivity in Nature – Tools and challenges	GSC Conference Room
13:30 - 18:00	Field trip (includes lunch)	USFQ
18:00 - 19:00	Free	
19:00	Dinner	Descanso del Marinero

### Thursday, 24 January 2019

Schedule	Activity	Location
06:30 - 08:30	Interisland travel to Santa Cruz Island	Tourism Pier
10:00 - 10:30	Welcome by the science coordinator of the CDF, María José Barragán	CDF Conference Room
10:30 - 11:00	Coffee break and poster session	CDF Terrace
11:00 - 13:00	Science for conservation expert panel: How to bring your science into action	CDF Conference Room
13:00 - 15:00	Lunch	CDF Terrace
15:00 - 17:00	Talks by Rufford grantees (6)	CDF Conference Room
17:00 - 18:30	Workshop: Conservation photography and Science Communication	CDF Conference Room
18:30	Dinner	The kiosks

### Friday, 25 January 2019

Schedule	Activity	Location
07:00 - 8:00	Breakfast	Hotel
08:00 - 10:00	Talks by Rufford grantees (6)	CDF Conference Room
10:00 - 11:00	Coffee break	CDF Terrace
11:00 - 13:00	Survey, summary of the main achievements of the conference, initial production of journal article draft. Closing ceremony and certificates of attendance.	CDF Conference Room
13:00 - 15:00	Lunch	CDF Terrace
15:00 - 18:00	Field trip to Tortuga Bay	CDF Conference Room
19:00	Dinner	Santa Cruz Brewery

#### Saturday, 26 January 2019

Departure from Santa Cruz Island

#### Talks

### Tuesday, 22 January 2019

**Session I:** 08:00 - 10:00

Schedule	Speaker	Title
08:00 - 08:15	Robert Lamb	Ecological impacts and environmental filters of herbivory in the Galapagos rocky subtidal
08:20 - 08:35	Maximilian Hirschfeld	The Galapagos Bullhead Shark Project – Balancing scientific discovery and conservation of an elusive marine species
08:40 - 08:55	Javier Oña	Acoustic ecology and song behavior in humpback whales ( <i>Megaptera novaeangliae</i> ) from the breeding grounds off the coast of Ecuador.
09:00 - 09:15	Mónica Gonzalez	A science-based approach to conserving the critically endangered Ecuadorian capuchin <i>Cebus aequatorialis</i>
09:20 - 09:35	Juan Pablo Muñoz	Marine plastic pollution
09:40 - 09:55	Ana María García- Cegarra	Effects of whale-watching tourism on humpback whale behavior in Peru: contrasting frequentist statistics with Bayesian inference

#### **Poster Session:** 10:00 – 11:00

#### **Session II:** 11:00 – 13:00

Schedule	Speaker	Title
11:00 - 11:15	Adriana Gonzalez Pestana	Prediciendo la distribución del tiburón martillo ( <i>Sphyrna zygaena</i> ) juvenil en el norte de Perú
11:20 - 11:35	Esteban Guevara	Plant-hummingbird interactions in changing environments: insights from work performed in the northwestern Andes of Ecuador
11:40 - 11:55	Shaleyla Kelez	Sea turtle diet in oceanic environments off Perú: Stable isotope mixing model results from green, loggerhead and olive ridley sea turtles
12:00 - 12:15	Hansel Herrera	Jaguar hunting behavior and activity patterns in a seasonally dry tropical forest
12:20 - 12:35	Elpis J. Chávez Calderón	Movements and habitat use of juvenile bull sharks ( <i>Carcharhinus leucas</i> ) in a Costa Rican estuary

#### Wednesday, 23 January 2019

**Session I:** 08:00 - 10:00

Schedule	Speaker	Title
08:00 - 08:15	Ninon Meyer	Spatial ecology and conservation of tapirs and white- lipped peccaries in Darien, Panama
08:20 - 08:35	Yasuni	Spatial ecology and conservation of juvenile blacktip

	Chiriboga	sharks ( <i>Carcharhinus limbatus</i> ) in San Cristóbal Island – Galapagos Marine Reserve
08:40 - 08:55	M. Camila Estrada- Flórez	Effects of Fragmentation on Functional Traits of Andean Bird Communities
09:00 - 09:15	Laura M. Vargas	Effects of forest structure on jaguar occupancy in <i>terra firme</i> Amazonian forests
09:20 - 09:35	Mayra Galindo	Analysis of the diversity of wild bees and their relation to plant communities in Los Besotes Regional Park, Valledupar – Cesar, Colombia
09:40 - 09:55	Cindy Meliza Hurtado	Mammal diversity and threats within the largest remnant of dry forest in the Pacific, the Cerros de Amotape National Park
10:00 -10:15	Diana P. Ochoa Castro	Biological validation of faecal cortisol metabolites in the Galápagos Sea Lion ( <i>Zalophus wollebaeki</i> )

### **Poster Session:** 10:00 – 11:00

#### **Session II:** 11:00 – 12:00

Schedule	Speaker/Co- Authors	Title
11:00 - 11:15	Ximena Velez Zuazo	Seven years after Rufford: a life full of sharks, rays, conservation, and outreach
11:20 - 11:35	Diana Pazmiño	Introgressive hybridisation between two widespread sharks in the east Pacific Region
11:40 - 11:55	Alexandra María Ávila Leoro	Genetic Diversity and Conservation of the Misty Grouper ( <i>Hyporthodus mystacinus</i> ) in the Galapagos Islands, Ecuador

### Thursday, 24 January 2019

#### **Poster Session:** 10:00 – 11:00

**Session I:** 15:00 – 17:00

Schedule	Speaker	Title
15:00 - 15:15	Aura Alonso Rodriguez	Oil palm expansion poses a threat to Costa Rican moth assemblages
15:20 - 15:35	Gustavo A. Castellanos- Galindo	How important are mangrove small-scale fisheries in the Eastern Pacific Ocean?
15:40 - 15:55	Inti Keith	Status and Trends of Marine Bioinvasions and Invasion Vectors in the Galapagos Archipelago and the Cocos Islands
16:00 - 16:15	Dalia Barragán- Barrera	Integrating research, outreach activities and education to conservation of an isolated bottlenose dolphin population in Bocas del Toro, Panama
16:20 - 16:35	Heinke Jäger	Terrestrial invasive species in the Galapagos
16:40 -16:55	Daniela Alarcón	Social behavior and foraging of killer whales in the Galapagos Marine Reserve.

#### Friday, 25 January 2019

**Session I:** 08:00 - 10:00

Schedule	Speaker	Title
08:00 - 08:15	Pedro Mendez Carvajal	Long-term monitoring of the howler monkey Alouatta coibensis coibensis and other mammals from Coiba Island, Coiba National Park, Republic of Panama
08:20 - 08:35	Héctor Emilio Ramírez Chaves	Endemic bats (Mammalia: Chiropter) of Colombia: state of knowledge, distribution, and conservation.
08:40 - 08:55	Nohelia Esperanza Farías Curtidor	Generating baseline data to conserve small cetaceans in La Guajira (Colombian Caribbean)
09:00 - 09:15	Víctor Montalvo Guadamuz	Population trends of Jaguar ( <i>Panthera onca</i> ), other felines and their potential prey in Santa Rosa National Park, Guanacaste, Costa Rica
09:20 - 09:35	Alexandra Cardona	What do we know about the endemic rodents of Colombia? Implications for their conservation
09:40 - 09:55	Daniela Vilema	Marine educational and outreach programs for the Galapagos community

#### **Poster Sessions:**

**Tuesday, 22 January 2019:** 10:00 – 11:00

Wednesday, 23 January 2019: 10:00 - 11:00

Thursday, 24 January 2019: 10:30 – 11:00

#	Presenter	Title
1	Hansel Herrera	Temporal segregation of jaguar, puma and ocelot in two tropical habitats of Costa Rica
2	Alvaro Gonzalo García-Olaechea	Mammal diversity and environmental education in the buffer area of the Amotapes-Manglares Biosphere Reserve, Peru
3	Andrea Borbón	Gut microbiota of Andean bears: a novel approach for examining health and habitat quality of captive and wild individuals
4	Jenilee Montes- Fontalvo	Comparative study of dragonfly diversity in habitats affected by artisanal mining and outreach in Afro- communities of Chocó, Colombia
5	Robert Lamb	El Niño drives habitat filtering and widespread disease in a tropical marine fish assemblage
6	Maximilian Hirschfeld	The Galapagos Bullhead Shark Project
7	Javier Oña	A giant's dance: Underwater Social and Vocal Behavior of Humpback Whales ( <i>Megaptera novaeangliae</i> ) recorded on the Northern Coast of Ecuador

#### **CONFERENCE ABSTRACTS**

#### **ORAL PRESENTATIONS**

1. Ecological impacts and environmental filters of herbivory in the Galapagos rocky subtidal

Robert W. Lamb<sup>1,\*</sup>, Franz Smith<sup>1</sup>, Jon D. Witman<sup>1</sup>

<sup>1</sup>Department of Ecology and Evolutionary Biology, Brown University, 80 Waterman St. Box G-W, Providence, RI 02912 – USA

\*Corresponding author: robert lamb@brown.edu

Environmental variation limits the distributions of species across space and affects the outcome of biotic interactions and population dynamics over time. It is unclear which species characteristics will favor resistance, resilience, or decline in response to the extremes of temperature, precipitation, and mechanical stress by wind and waves associated with alobal climate change. I explore the wide oceanographic variation and relatively pristine fish communities of the Galapagos Islands as a model system to study the ecological outcomes of variation in environmental stress. In response to a local, high-frequency stress (wave exposure), I found that speed of locomotion dictates the ability of herbivores to navigate high wave exposure. In this case, mobility is the factor that best predicts an herbivore's ability to continue feeding and exerting top-down control of benthic communities under periodic environmental stress. Tracking reef fish population trajectories over 6 years in response to a regional, low-frequency stress (El Niño events), I compared the predictive capacity of factors directly related to physiological tolerance to climate change (biogeographic and phylogenetic effects) with traits indirectly related to the effects of climate change on limiting resources (trophic and habitat effects). Planktivores were most susceptible to population declines during El Niño, but showed remarkable resilience by bouncing back during the subsequent La Niña one year later. At the height of the 2015-16 El Niño event, the strongest in recent history, I also observed a novel ulcerative skin disease affecting 18 different species of reef fish. Associated with a bacterium Rahnella sp., the disease was temperature and density-dependent, and disappeared as El Niño subsided. By studying the effects of environmental variation on reef fish communities, I aim to provide a trait-based framework for predicting the trajectory of ecological communities under climate change.

Keywords: climate change, foraging, reef fishes, El Niño, wildlife disease, environmental stress

# 2. The Galapagos Bullhead Shark Project – Balancing scientific discovery and conservation of an elusive marine species

Maximilian Hirschfeld<sup>1,3\*</sup>, Adam Barnett<sup>1</sup>, Christine Dudgeon<sup>2</sup>, Juan García<sup>4</sup>, Marcus Sheaves<sup>1</sup> <sup>1</sup>James Cook University, College of Science and Engineering, Townsville QLD 4810, Australia <sup>2</sup>Molecular Fisheries Laboratory, School of Biomedical Sciences, The University of Queensland, St. Lucia QLD 4072, Australia

<sup>3</sup>Galapagos Science Center, Universidad San Francisco de Quito, Quito 170157, Ecuador <sup>4</sup>Galapagos National Park Services, Galapagos Islands, Ecuador

\*Corresponding author: maxh@enphocus.net

Demersal sharks are thought to have limited dispersal capacity due to their physiological and behavioral adaptations to living on or closely related to the sea floor. However, some shallow-water demersal species have managed to thrive at geographically remote locations, such as oceanic islands. This isolation may lead to low levels of population connectivity and a lack of replenishment from adjacent locations, making local stocks more susceptible to human exploitation and natural disturbance. The Galápagos bullhead shark (Heterodontus quoyi) was described as early as 1840, but to date very little scientific information exists for this species. The benthic shark is thought to have a small geographic range limited to the coast of Perú and the Galápagos Archipelago. Since 2015, the Galápagos bullhead shark project aims to shed first light on the geographic distribution, life history, demographic and genetic structure of this elusive species. Here we introduce a unique combination of non-invasive sampling methods, including underwater blood collection. Between 2015 and 2018, a total of 198 tissue samples (87 females and 111 males) and 188 blood samples (79 females and 109 males) were collected from seven locations on five islands. Four lines of evidence combine geographic distribution with morpholoaical life history data, such size at maturity, measurements, as and genetic/genomic data to assess population subdivision in the eastern Pacific. This integrative approach may improve the description of ecologically and genetically distinct units and evaluate the vulnerability of the Galápagos bullhead shark population throughout its entire geographic range. The results may ultimately be used to develop effective strategies for local and regional fisheries and conservation management. We propose that our approach can be used to study rare and understudied wildlife to generate scientific baseline data while integrating conservation targets.

Keywords: Demersal sharks, geographic isolation, body morphology, population genomics, applied conservation

# 3. Acoustic ecology and songs of humpback whales (Megaptera novaeangliae) at north off the coast of Ecuador.

Javier Oña<sup>1</sup>, Julia Maldonado<sup>2</sup>, Judith Denkinger<sup>1</sup>, Ellen C. Garland<sup>3</sup>

<sup>1</sup> Colegio de Ciencias Biológicas y Ambientales y Galapagos Science Center, Universidad San Francisco de Quito, Campus Cumbaya, Quito, Ecuador.

#### E-mail: ecujavier10@gmail.com

<sup>2</sup> Universitá degli Studi di Torino, Dipartimento di Scienze

della Vita e Biologia dei Sistemi, Via Accademia Albertina 13, 10123.

<sup>3</sup> Centre for Social Learning and Cognitive Evolution, and Sea Mammal Research Unit, School of Biology, University of St. Andrews, St. Andrews, Fife KY16 9TH, UK

#### Abstract

The research provides information about aspects of acoustic ecology and song behavior of humpback whales in Esmeraldas coast located at the north of Ecuador. Since 2012 to 2017, we carried out acoustic monitoring of social groups (included singers) over different depths and bottom composition type. High-quality recordings presented clear song pattern was used to know the distribution and habitat preference of singers whales for the local breeding areas. Song behavior was processed and explored using Raven Pro for frequency spectrogram visualization and Praat software to carry out a semi-automatic analysis for classification. Singers distribution appear to occur often both shallow and offshore water with a possible preference of mixed substrates composed for sandy and rocks. While that a temporal variation of humpback songs was evidenced in each breeding season. Preliminary analyses of song units classification showed similitudes between consecutive years but not among distant years, assumed a change important according to cultural transmission context occurring in the West Pacific. Understanding the songs structure, distribution, and habitat preference of singers and another, as a highly migratory social group vulnerable to anthropogenic disturbance is essential for conservation efforts at a regional and temporal scale at the Southeastern Pacific humpback whales populations.

Key words: Singer, song, spatial distribution, habitat preference, depth, sea floor substrate, humpback whale, *Megaptera novaeangliae*,.

#### 4. A science-based approach to conserving the critically endangered Ecuadorian capuchin Cebus aequatorialis

González M.<sup>1</sup>, Olivo J.<sup>1</sup>, Cabrera D<sup>1</sup>, Castillo F.<sup>1</sup>, Karubian J.<sup>1,2</sup>

<sup>1</sup>Fundación para Conservación de los Andes Tropicales (FCAT)

<sup>2</sup>Tulane University, Department of Ecology and Evolutionary Biology.

\*Autor para correspondencia: monigon510@hotmail.com

The Ecuadorian capuchin, Cebus aeguatorialis, is a critically endangered primate according to the IUCN. The basic biology and distribution of the species are poorly understood, and conservation efforts in Ecuador are limited. In 2014, we monitored 27 forest fragments in the Mache Chindul Ecological Reserve and recorded three previously unknown capuchin populations, after which we initiated a series of conservation measures that included education, training, and reforestation. In 2015 we expanded our sampling effort to include 13 additional fragments, which we monitored for 10 consecutive months. By using a combination of regular and opportunistic monitoring methods, we identified three other populations of the study species. We shared our findings and promoted the conservation of the Ecuadorian capuchin with representatives in the Ministry of the Environment and organizations involved with the research and conservation of the species. We organized a well-attended environmental fair (1200 participants, including adults, youth, and children) focused on encouraging conservation actions for the Ecuadorian capuchin. Additionally, we shared the results with local residents through workshops and informal meetings. Finally, we created a nursery for the production of 12,000 seedlings of native tree species that were distributed to the landowners of four "priority" forest fragments, with the aim of expanding the available habitat for Ecuadorian capuchins and trying to increase connectivity among the currently isolated populations. This project combined scientific research, local capacity building, and community engagement and outreach to further conservation efforts of the critically endangered Ecuadorian capuchin.

Key words: Capuchin monkey, forest fragmentation, habitat conservation, Mache Chindul Ecological Reserve

#### 5. Effects of whale-watching tourism on humpback whale behavior in Peru: contrasting frequentist statistics with bayesian inference

García-Cegarra, A.M.1\*, Villagra, D.<sup>2</sup>, Gallardo, D.I.<sup>3</sup>, Pacheco, A.S<sup>4</sup>.

<sup>1</sup> Doctorado en Ciencias Aplicadas mención Sistemas Marinos Costeros, Universidad de Antofagasta, Chile

<sup>2</sup> Facultad de Ciencias, Universidad Nacional Agraria La Molina, Perú

<sup>3</sup> Departamento de Matemáticas, Facultad de Ingeniería, Universidad de Atacama, Copiapó, Chile

<sup>4</sup> Instituto de Ciencias Naturales Alexander von Humboldt, Laboratorio CENSOR, Universidad de Antofagasta, Chile

\*Autor para correspondencia: <u>anamaria.garcia@uantof.cl</u>

Whale-watching is a growing tourism activity worldwide. Whale-watching effects on cetacean species behavior have been demonstrated in several countries. However, when aiming to assess whether a disturbance leads to a behavioral change, factors such as habitat type and life history are likely to affect the type of response. This study aimed to detect changes in breathing frequency, surface time, mean diving intervals, path directness and swimming speed of humpback whale groups before, during and after whale-watching boat encounters in their breeding area in northern Peru. A total of 167.2 hours of land-based observations were performed during 50 days (from August to October 2016) from a cliff located 31 m above sea level at Los Organos (4°10'43"S, 81°08'44"W). A total of 179 humpback whale groups were tracked by using a theodolite, 46.7% of which were groups with calf. While frequentist statistical analysis showed that humpback whale groups with calf increased significantly in path linearity after boat encounters, Bayesian inference analysis detected behavioural changes in the rest of the response variables. Groups with calf decreased the number of mother breaths, mean diving intervals and swimming speed and increased calf surface times. Bayesian inference proved to be a more sensitive tool than frequentist statistics to assess whale-watching effects on humpback whale behavior. Whale-watching activity in Peru must be regulated emphasizing the importance of protecting humpback whale mother and calf groups.

Key words: Megaptera novaeangliae, whale-watching, breeding area, stock G, human disturbance.

# 6. Habitat suitability of the juvenile smooth hammerhead shark (Sphyrna zygaena) off northern Peru

Gonzalez-Pestana A.<sup>1,2\*</sup>, Gonzalez-Pestana N.<sup>3</sup>, Alfaro-Shigueto J.<sup>2,4,5</sup>, Mangel J.C.<sup>2,5</sup>, Simpfendorfer A.<sup>6</sup>

<sup>1</sup>James Cook University, Townsville, QLD 4811, Australia <sup>2</sup>ProDelphinus, Jose Galvez 780, Lima 18, Peru <sup>3</sup>Pontificia Universidad Catolica del Perú, Av. Universitaria 1801, San Miguel, Lima, Peru

<sup>4</sup>Universidad Científica del Sur, Facultad de Biología Marina, Panamericana Sur, Km 19, Lima, Peru

<sup>5</sup>Centre for Ecology and Conservation, School of Biosciences, University of Exeter. Cornwall Campus, Penryn, Cornwall TR10 9EZ, United Kingdom

<sup>6</sup>Centre for Sustainable Tropical Fisheries and Aquaculture, & College of Science and Engineering, James Cook University, Townsville, QLD 4811, Australia

\*Autor corresponsal: adriana@prodelphinus.org

The smooth hammerhead shark (Sphyrna zygaena) is one of most captured shark species in southeastern Pacific fisheries. Their distribution and habitat use is poorly understood hindering the identification of critical habitats for their conservation. The aim of this research was to predict the spatial distribution of smooth hammerheads based on habitat suitability off northern Peru (06-11°S). Three analyses were performed by using 7373 occurrence records between 2009 and 2017: i) characterize their population structure, ii) identify environmental factors that affect their distribution, and iii) predict their suitable spatial and environmental habitat during La Niña and El Niño (ENSO) and in a future scenario of climate change. The results indicate that northern Peru is a key area for juvenile smooth hammerheads, and their spatial distribution varies according to their ontogeny, season and ENSO conditions. Four environmental variables are important predictors of shark distribution: depth, sea surface temperature, and chlorophyll-a, as a proxy of prey availability. Suitable habitat was predicted to be more nearshore in El Niño conditions compared to La Niña conditions, as the coastal upwelling area offers the coolest environment and the highest productivity, especially during warmer conditions. The highest habitat suitability was predicted in an ecotone zone in northern Peru that presents unique oceanographic and bathymetric conditions. Under future climate change scenarios, their habitat suitability will shift to a more coastal distribution, increasing their vulnerability to fisheries. To enhance the conservation of smooth hammerheads and their supporting ecosystem, this area of high suitability should be a priority for further research and management.

Key words: ecological niche, distribution, El Niño, climate change

# 7. Plant-hummingbird interactions in changing environments: insights from work performed in the northwestern Andes of Ecuador

Esteban A. Guevara<sup>1,2\*</sup>, Tatiana Santander<sup>2</sup> y Catherine H. Graham<sup>1</sup>

<sup>1</sup> Biodiversity and Conservation Biology Unit, Swiss Federal Research Institute WSL. Zürcherstrasse 111, 8903 Birmensdorf, Switzerland

<sup>2</sup> Área de Investigación y Monitoreo de Avifauna, Aves y Conservación – BirdLife in Ecuador.

Mariana de Jesús E7-69 y La Pradera, Código Postal EC170518, Quito, Ecuador

\*correspondence author: <u>esteban.guevara@wsl.ch</u>

Drivers of global change such as climate and land-use change influence the abundance and distribution of organisms, and these changes in turn affect the way in which species interact. Ecological interactions among plants and animals allow for the maintenance of biodiversity and sustain important ecosystem services like pollination, yet we lack of a deep understanding of how plant-animal interactions will respond to drivers of global change. In this project, we investigate how interactions between hummingbirds and their food plants change across gradients of elevation and land-use. To do this we perform observations with time-lapse cameras and census of floral resources at 14 transects with two levels of land-use, forest (7) and pasturelands with remnant vegetation (7). Preliminary data indicate that several species of plants receive fewer visits of large hummingbirds in more disturbed areas (ANOVA, F=4.45, df=2, P<0.05), which might affect the reproductive output of this group of plants and ultimately influence the composition of plant communities in disturbed areas. Additionally our results from flower censuses suggest seasonal peaks of flower abundances, which vary in time at different sites along the elevation gradient. Further steps of this research will address the influence of flower morphology on hummingbird specialization. The information obtained through our two Rufford grants has been critical to leverage additional funding to propagate plants that are key resources for hummingbirds in highly disturbed areas, which could benefit species of conservation concern like the Black-breasted Puffleg.

Key words: Black-breasted Puffleg, conservation, ecology, interaction strength, restoration

# 8. Sea turtle diet in oceanic environments off Peru: Stable isotope mixing model results from green, loggerhead and olive ridley sea turtles

Shaleyla Kelez<sup>1\*</sup>, Jeffrey A. Seminoff<sup>2</sup> y Larry B. Crowder<sup>3</sup>

1ecOceánica, Lima, Perú

2Southwest Fisheries Science Center, La Jolla, California, EE. UU.

3Standford University, California, EE. UU.

\* shaleyla.kelez@ecoceanica.org

The foraging ecology of sea turtles in the open ocean remains a poorly researched subject. Most studies have been conducted on loggerhead sea turtles and there are no studies involving multiple species in the same oceanic region. In this light, we studied the foraging ecology of three sea turtle species: loggerheads, greens and olive ridleys captured in oceanic environments off Peru. We collected skin samples from 138 sea turtles that were incidentally captured by longline vessels and 65 samples from 19 potential prey taxa. The majority of collected species had already been reported as prey of sea turtles. These include pelagic crabs, pelagic gooseneck barnacles, purple-striped jellyfish, blue buttons, and blue sea slugs. We also included samples from the two species that are most commonly used as bait in pelagic longline fisheries off Peru; Humboldt squid and chub mackerel. The bait samples were included to test the importance of longline baits in the diet of oceanic sea turtles. We used stable carbon ( $\delta$ 13C) and nitrogen ( $\delta$ 15N) isotope analysis to investigate trophic ecology of sea turtles. Stable isotope values were determined for all turtle and prey tissue samples. We used the Bayesian isotope mixing model Stable Isotope Analysis in R (SIAR) to estimate the contribution of different food sources to the diets of all three turtle species. The model outputs depict diverse diets for each species, but pinpoint the prey groups with the highest contribution to each species diet. The models also reflect varying importance of longline baits among turtle species. To our knowledge this is the first multispecies study of sea turtle trophic ecology in oceanic environments. The results will add greatly to our understanding of oceanic life stages and the conservation of sea turtles in the Southeast Pacific.

Keywords: multispecies, diet analysis, longline bait, oceanic habitat use, foraging ecology

#### 9. Jaguar hunting behavior and activity patterns in a seasonally dry tropical forest

Hansel Herrera<sup>1\*</sup>, Eduardo Carrillo<sup>2</sup>, Joel Saenz<sup>2</sup> y Grace Wong<sup>2</sup>

<sup>1</sup> Iniciativa Osa & Golfito, Woods Institute for the Environment, Stanford University, Puntarenas, Costa Rica.

<sup>2</sup> Instituto Internacional en Manejo y Conservación de Vida Silvestre, Universidad Nacional, Campus Omar Dengo, Heredia, Costa Rica.

\*Autor para correspondencia: <u>bluecloudcr@gmail.com</u>

The jaquar (Panthera onca) is a widespread felid whose diet and activity patterns are highly variable throughout its range. Its behavior and food habits are generally determined by the abundance and distribution of prey, habitat characteristics, climatic conditions and the presence of potential competitors. In this study, we assessed the influence of terrestrial and marine prey on the daily activity patterns and hunting behavior of jaguars in Northwestern Costa Rica. We used camera traps to determine the activity schedules of jaguars and their terrestrial prey, and quantified the temporal overlap between them. We surveyed two local beaches in order to determine the magnitude and spatial and temporal distribution of sea turtle predation by jaguars. Jaguars were active 45% of the time and showed a primarily nocturnal activity pattern, with peaks at dawn and dusk. Temporal overlap with prey species was relatively low (>40%), while the presence and activity of jaguars on the beach was strongly correlated with the nesting cycles of marine turtles. In a six month period, jaguars killed 51 sea turtles of two different species. More than 50% of them were killed during the last quarter of the lunar cycle. Predation occurred mainly at the southern end of the beach, probably as a consequence of human presence on the opposite side. The strong nocturnal activity of jaguars observed in this study and their synchrony with sea turtle nesting cycles suggest that turtles are important prey for the local jaguar population.

Keywords: Guanacaste Conservation Area, Santa Rosa National Park.

#### 10. Movements and habitat use of juvenile bull sharks (Carcharhinus leucas) in a Costa Rican estuary

Elpis J. Chávez Calderón<sup>1, 2\*</sup>, Randall Arauz<sup>3</sup>, Mario Espinoza<sup>4, 5</sup> y Manuel Spinola<sup>1</sup>

<sup>1</sup> Instituto Internacional en Manejo y Conservación de Vida Silvestre, Universidad Nacional, Campus Omar Dengo, Heredia, Costa Rica.

<sup>2</sup>Centro de Rescate de Especies Marinas Amenazadas, Barva, Heredia, Costa Rica. <sup>3</sup>Fins Attached Marine Research and Conservation, Colorado Springs, USA.

<sup>4</sup>Centro de Investigación en Ciencias del Mar y Limnología, Universidad de Costa Rica, San José, Costa Rica.

<sup>5</sup>Escuela de Biología, Universidad de Costa Rica, San José, Costa Rica. \*Autor para correspondencia: <u>echavk@gmail.com</u>

The bull shark (Carcharhinus leucas) is a coastal species with a great affinity for estuarine habitats during its early life stages. Habitat use and movement patterns of juvenile C. leucas in coastal ecosystems might result from biotic and abiotic factors (physiological tolerance, low predation risk and prey availability). We examined the movement patterns, daily activity and habitat use of juvenile bull sharks in the Coyote estuary (northern Pacific coast of Costa Rica) through the use of acoustic telemetry techniques. Additionally, we investigated the influence of environmental factors on the movements and presence of juvenile C. leucas. Six bull sharks were tagged and monitored during 5–146 days. All sharks presented a high residency (IR>0.5) and site fidelity (<100 m). The juvenile bull sharks used ~70% of the estuary and were found in salinities of 5-34 ppt, temperatures between 27.2 - 32.3°C and depths of 0.2 – 13.3 m. Bull sharks remained inside the estuary all day, particularly during daylight hours and swam towards the coast at night. During the day, bull sharks remained in shallow waters and moved to greater depths at night, which could be related to increased hunting success and energy optimization. Compared to other similar studies, the movement patterns and home ranges of juveniles of bull sharks found in this investigation were distinct. Our results show evidence of connectivity between estuarine and coastal habitats and highlights the importance of the Coyote estuary for the early stages of the bull sharks in the Pacific coast of Costa Rica.

Keywords: Acoustic telemetry, connectivity, chondrichthyes, residency, tropical ecosystem.

#### 11. Spatial ecology and conservation of tapirs and white-lipped peccaries in Darien, Panama

Ninon Meyer<sup>1,2\*</sup>, Ricardo Moreno<sup>1</sup>

<sup>1</sup>Fundacion Yaguara-Panama, Cuidad del Saber, Panamá

<sup>2</sup>El Colegio de la Frontera Sur, Campeche, Mexico

\*Corresponding author: <a href="mailto:ninonmeyer@gmail.com">ninonmeyer@gmail.com</a>

Baird's tapir Tapirus bairdii and the White-lipped peccary (WLP) Tayassu pecari are two Neotropical keystone species that are endangered mainly due to habitat loss and hunting. In Panama they have been extirpated from many sites, including protected forests. Despite this critical situation, the two species have long remained overlooked by Panama's conservation agenda, in part because no studies had been conducted on them and so the magnitude of the problem was unknown. Here we investigated the spatial ecology and population status of the WLP and the tapir in Darien. Together with an indigenous Embera community, we conducted camera traps surveys and fitted GPS collars on WLP. Since we started the monitoring program in 2014, the population trend of most large mammals species has remained stable and the occupancy of all endangered species is higher than in the rest of Panama. Home ranges of WLP (30 - 55km<sup>2</sup>) were relatively small compared to other localities in the Neotropics, whereas the size of the herds was high (80 - 100 individuals). Our results indicate the centrality of Darien for the conservation of endangered mammals at a regional level. Moreover, a major outcome of this project is the success in partnering with local people. However, the area remains fragile and under several threats. Therefore, we plan on continuing this project, while advising the local and national government to make sure Darien remains a safe haven for these and other imperilled yet important species.

Keywords: Darien, Baird's tapir, White-lipped peccary, GPS telemetry, Camera trapping

#### 12. Spatial ecology and conservation of juvenile blacktip sharks (Carcharhinus limbatus) in San Cristóbal Island – Galapagos Marine Reserve

Chiriboga Y. 1 \* y Hearn A. 1

<sup>1</sup> Galapagos Science Center, Universidad San Francisco de Quito y la Universidad de Carolina Del Norte en Chapel Hill, San Cristóbal, Galapagos, Ecuador

\*autora correspondiente: <u>yasuni.chiriboga@hotmail.com</u>

The Galapagos Marine Reserve is home of large schools of Carcharhinus limbatus, even so, very little is known of their juvenile stage. Only 25% of the coastline corresponds to mangrove habitats, which are key areas for the development of blacktip juveniles. Artisanal fishing is allowed along 77% of the coastline, including nursery grounds, and the mortality of juveniles from bycatch could be high. We studied the abundance and movement patterns of C. limbatus in nursery areas in San Cristóbal Island in order to monitor the population and identify the most used areas by this species. Carrying out monthly outings between 2016 and 2017, 368 individuals were monitored and 17 individuals were internally tagged using acoustic telemetry. We observed a 1:1 sex ratio and an age composition of 84% juveniles of the year and 16% neonates. For movement behavior, greater nocturnal activity was found outside the bay in which they were tagged, confirming that juveniles make exploratory movements to other areas, but always return to their main nursery ground. High site fidelity, residence and connectivity between nursery greas demonstrate the importance of these zones. This study is the beginning of a longterm monitoring program in San Cristóbal Island, and the results will be provided to the National Park Directorate to evaluate the effectiveness of the new zoning scheme of the Marine Reserve.

Keywords: C. *limbatus*, nursery grounds, movements, conservation, Galapagos Marine Reserve.

#### 13. Effects of fragmentation on functional traits of Andean bird communities

#### M. Camila Estrada-Flórez<sup>1</sup>

<sup>1</sup> Universidad Nacional de Colombia, Sede Medellín. Facultad de Ciencias Agrarias. Calle 59a #63-20, Medellín, Colombia.

Corresponding author: mcestradaf@unal.edu.co

The conversion and fragmentation of tropical forests is an accelerating process that potentially negatively affects regional biodiversity. Most fragmentation studies have been conducted in the lowlands, with relatively few studies conducted in the Andes. We used a functional trait approach to assess the effects of fragmentation on bird communities in a hyper-diverse tropical ecosystem—the Colombian Andes—in which most of the landscape has been converted to agriculture and remnant forests are highly fragmented, but also in which habitats tend to be naturally fragmented and disturbance-prone as a result of topographic variation and frequent landslides. We set out to test the predictions that fragmentation decreases: (1) functional diversity and specialization, (2) taxonomic diversity and (3) functional composition. Specifically, we compared the taxonomic and functional diversity (richness, evenness and divergence), and the functional specialization in seven forest fragments of different sizes in the northern Andes of Colombia, evaluated during 2015. Only taxonomic diversity and functional richness were significantly negatively correlated with fragment size. We found no significant differences in the functional composition of the fragments. Our results suggest that the effects of fragmentation on avian community composition may not be as strong in Andean forests than in other landscapes. Factors such as higher resilience of Andean birds to natural disturbances and fragmentation could allow them to persist in disturbed habitats better than species inhabiting other environments such as lowland forest birds. These results highlight the importance of a multifaceted approach to analyse changes in biodiversity associated with human disturbances, especially in the Neotropics.

Key words: Anthropic disturbances, Andean ecosystems, birds, functional divergence, functional richness, Colombian Andes

#### 14. Effects of forest structure on jaguar occupancy in terra firme Amazonian forests

Laura M. Vargas<sup>1\*</sup> and Gabriel J. Colorado Zuluaga<sup>1</sup> 1 Laboratorio de Ecología y Conservación de Fauna y Flora Silvestre, Universidad Nacional de Colombia, Sede Amazonia, Leticia, Colombia Autor para correspondencia: <u>Imvogg@gmail.com</u>

The jaguar (Panthera onca), is one of the most emblematic species of the American continent, and its largest land predator. At present its available habitat has been reduced by almost 54% relative to its original distribution by deforestation, hunting of its prey, habitat degradation, and the traffic of skins. In the Amazon region however, a block of continuous habitat persists which allows the species to travel throughout most of the countries of South America, including Colombia. The population densities of jaguars in the Amazon are considered low in contrast to more open habitats such as the Pantanal. For this reason, it is very important to establish the environmental conditions that can favor the persistence of the species, especially because human colonization of the Amazonian forests implies that the potential interaction of both species will be increasing. In this project we estimated the occupancy of jaguars in an area of 400 km<sup>2</sup> using photo-trapping along a gradient of anthropogenic influence in the southern Colombian Amazon. Forest structure variables were quantified in order to evaluate their relationship with the distribution of the species. The jaguar was detected in 7 of 43 localities sampled, mainly during the dry season. Presence was positively associated with large bodies of water and negatively associated with human settlements. This is one of the first ecological studies of the jaguar for Amazonian ecosystems, establishing the factors that are potentially favorable for the long-term conservation of the jaguar in the region.

Keywords: jaguar, habitat, photo-trapping

#### 15. Analysis of the diversity of wild bees and their relation to plant communities in Los Besotes Regional Park, Valledupar – Cesar, Colombia

Galindo M.1\*, Sabogal A.2, Smith A.3, Ortega M4.

 <sup>1</sup> Maestría en Bosques y Conservación Ambiental, Universidad Nacional de Colombia
 <sup>2</sup> Centro de Investigación en Acarología
 <sup>3</sup> Departamento de Agricultura de los Estados Unidos (USDA)
 <sup>4</sup> Universidad Nacional de Colombia sede Medellín.
 \*Autor para correspondencia: <u>fundacionuraku@gmail.com</u>

The richness and incidence of species of wild bees (Hymenoptera: Apoidea: Anthophila) in a dry forest of the Regional Park - Los Besotes was analyzed in three zones: A (900-1000 m) dominated by Machaerium biovulatum, B (600-700 m) by Eugenia procera and C (200-300 m) by scrub and herbaceous vegetation. Sampling was carried out in April (dry) and June-July (rainy season) in 2015. Van Someren traps, aromatic essences and manual capture were used. Nonparametric richness estimators were calculated to construct a species accumulation curve for the total sample. We performed an alpha diversity analysis with the diversity profiles based on Hill numbers for the three zones and two seasons. Beta diversity was evaluated with the Jaccard Classic and Jaccard adjusted indexes based on incidence. A total of 3794 individuals belonging to 45 species of the Halictidae and Apidae families were collected, the latter having the highest number of species in both seasons, and Trigona amalthea was the most abundant species (732 individuals). According to the diversity profiles for the data obtained, the dry season reached the greatest diversity. Zone C had the highest values, although IC were overlapping for richness. The assemblage of wild bees in the Regional Park Los Besotes presents a great adaptability to the seasonal and elevational variation in the supply of the floral resources, both seasonally and altitudinally; the latter related to the strong differences in floristic composition.

Key words: Apidae, tropical dry forest, conservation, Halictidae, richness.

# 16. Mammal diversity and threats within the largest remnant of dry forest in the Pacific, the Cerros de Amotape National Park

#### Hurtado C. M.<sup>1,2\*</sup>

<sup>1</sup> Centro de Investigación Biodiversidad Sostenible - BioS, Perú <sup>2</sup> Department of Forest Resources Management, University of British Columbia, Canadá \*Autor para correspondencia: cindymeliza@gmail.com

The Pacific dry forest is one of the most threatened ecosystems in the world because it has lost roughly 90% of its original forest cover and several species of birds and plants have gone extinct. Despite this ecosystem's importance, its mammal diversity and threats were poorly known before this study. From August 2012 to April 2013, 21 camera traps and six line transects were installed in three sectors of the Cerros de Amotape National Park (CANP). After 215 km of census and 4077 camera-days, 22 species of medium to large-sized mammals were registered, including the critically endangered Ecuadorian capuchin monkey (Cebus aeguatorialis). Also, the centroamerican aguoti (Dasyprocta punctata) was registered for the first time in Peru, extending its known range by 205 km south. Similarly, the paca (Cuniculus paca) and kinkajou (Potos flavus) were the first records for the western slope of the Peruvian Andes, extending their southern range by 70 and 72 km, respectively. Additionally, the local extinction of the jaguar (Panthera onca) and Andean bear (Tremarctos ornatus) were documented in this study. Evidence of hunting (Pecari tajacu, Mazama americana, and Cuniculus paca) and conflict between carnivores (Leopardus pardalis and Puma concolor) and local people was also found within and in the surrounding areas of the CANP. These results motivated further carnivore monitoring and wildlife corridor identification for the Pacific dry forest remnants of Ecuador and Peru, in order to prevent further species extinctions and to broaden our understanding of carnivore requirements to persist in fragmented landscapes.

Key words: human-carnivore conflict, hunting, local extinction, range extension.

#### 17. Biological Validation of Faecal Cortisol Metabolites in the Galápagos Sea Lion (Zalophus wollebaeki)

Diana P. Ochoa Castro1,\*, Diego Páez-Rosas1, 2, Rupert Palme3

1 Universidad San Francisco de Quito, USFQ, Extensión Galápagos, Colegio de Ciencias

Biológicas y Ambientales COCIBA y Galapagos Science Center GSC, Ecuador 2 Dirección del Parque Nacional Galápagos, Oficina Operativa Técnica de San Cristóbal,

Galápagos, Ecuador 3 University of Veterinary Medicine, Vienna, Austria Corresponding email | E-mail: dianaochoac@googlemail.com.

The Galápagos Sea Lion (Zalophus wollebaeki) is amongst the most fragile species of pinnipeds in the world given their tropical habitat, isolation and low population numbers. In 2008 the species was categorised as Endangered by the IUCN after two significant El Niño events and the increase of introduced threats. El Niño events have reduced population numbers by around 50% in the last 30 years and although numbers don't seem to be decreasing, populations are not recovering either. Other factors linked to human activity, such as pathogen introduction and climate change are also a significant threat to all species in the archipelago. By applying noninvasive field methodology, we attempted to understand the magnitude of human impact in a population of Sea Lions that cohabits a human settlement of around 6000 people. We utilised an opportunistic situation of stress (fireworks) to measure the concentration of FCM (fecal cortisol metabolites) across the population before and after the event. While the behavioural response to stress is evident across all members of the population - and in various other species - it was not possible to obtain biological validation of FCM's in this wild species. Despite not obtaining the desired physiological results; since the study, local authorities have banned firework events in San Cristóbal. A significant conservation milestone was achieved in part due to raised awareness. Conservation policy that will benefit all species across the islands.

Key words: Biological validation; FCM; conservation; policy; Galapagos National Park.

#### 18. Seven years after Rufford: a life full of sharks, rays, conservation, and outreach

#### Ximena Velez-Zuazo<sup>1\*</sup>

<sup>1</sup>Center for Conservation and Sustainability, Smithsonian Institution, Washington DC, USA

#### \*Autor para correspondencia: <u>velezx@si.edu</u>

In 2011, I was awarded a Rufford Small Grant to fund my PhD thesis. This grant made my journey to four countries to investigate the shark fishery possible, and it was a crucial seed fund for other initiatives that materialized long after I finished graduate school. In my presentation, I will tell a story of what became possible through the grant, including my travel experiences, the main results of my research, and how all of these fueled initiatives to study and communicate about sharks and promote their conservation. I will start presenting about the trips made during my PhD that included journeys to Costa Rica, Peru, Chile, and the US (San Diego and Florida). These trips made it possible to investigate the level of connectivity among and within aggregations of four species of sharks (Sphyrna zygaena, Prionace glauca, Carcharhinus falciformis, e Isurus oxyrinchus) in the Pacific basin. Visiting landing ports (N=4) and using DNA barcoding to identify shark species highlighted how little we knew about sharks, particularly in Peru. This inspired the preparation of an identification guide for sharks of commercial importance, an infographic, and an animated video about sharks. Aside from strict research, I also engaged in other initiatives, including producing an illustrated children's book about sharks, mentoring young Peruvian researchers on their path to graduate school, and organizing the First Peruvian Symposium of Sharks, Rays, and Chimaeras. I will finish with presenting on-going work and will highlight the unexpected opportunities Rufford grantees can have even after the (first) grant is over.

Keywords: Rufford, elasmobranchs, fisheries genetics, children's book, southeast Pacific

### 19. Introgressive hybridisation between two widespread sharks in the east Pacific Region

Diana A. Pazmiño<sup>1,2,3\*</sup>, Lynne vanHerwerden<sup>2,3</sup>, Colin A. Simpfendorfer<sup>2</sup>, Claudia Junge <sup>4,5</sup>, Stephen C. Donnellan<sup>4,6</sup>, E. Mauricio Hoyos-Padilla<sup>7</sup>, Clinton A. J. Duffy<sup>8,9</sup>, Charlie Huveneers<sup>10</sup>, Bronwyn Gillanders<sup>4</sup>, Paul A. Butcher<sup>11</sup>, Gregory E. Maes<sup>2,3,12,13</sup>

<sup>1</sup> Galápagos Science Center, Universidad San Francisco de Quito. Isla San Cristóbal, Galápagos, 200150, Ecuador; email: dapazmino@usfq.edu.ec

<sup>2</sup> Centre for Sustainable Tropical Fisheries and Aquaculture, College of Science and Engineering, James Cook University, Townsville, 4811 QLD, Australia.

<sup>3</sup> Comparative Genomics Centre, College of Science and Engineering, James Cook University, Townsville, 4811 QLD, Australia.

<sup>4</sup> School of Biological Sciences and Environment Institute, The University of Adelaide, SA 5005, Australia. <sup>5</sup> HAI Norge, Oslo, Norway

<sup>6</sup>South Australian Museum, North Terrace, Adelaide, Australia 5000

<sup>7</sup> Pelagios-Kakunjá A.C. Sinaloa 1540, La Paz, Baja California Sur CP 23020, México.

<sup>8</sup> Auckland War Memorial Museum, The Domain, Auckland, New Zealand.

<sup>9</sup> Department of Conservation, Private Bag 68908, Newton, Auckland 1145, New Zealand.

<sup>10</sup> College of Science and Engineering, Flinders University, Adelaide, 5042 SA, Australia.

<sup>11</sup> New South Wales Department of Primary Industries, National Marine Science Centre, Coffs Harbour, 2450 NSW, Australia.

<sup>12</sup>Laboratory of Biodiversity and Evolutionary Genomics, University of Leuven, B-3000 Leuven, Belgium.

<sup>13</sup> Laboratory for Cytogenetics and Genome Research, Center for Human Genetics, Genomics Core, KU Leuven, 3000 Leuven, Belgium.

With just a handful of documented cases of hybridisation in cartilaginous fish, shark hybridisation remains poorly investigated. Small amounts of admixture have been and dusky detected between Galapagos (Carcharhinus aalapagensis) (Carcharhinus obscurus) sharks previously, generating a hypothesis of ongoing hybridisation. We sampled a large number of individuals from areas where both species co-occur (contact zones) across the Pacific Ocean and used both mitochondrial and nuclear genome-wide markers to examine genetic admixture and introgression between the two species. Using empirical analytical approaches and simulations, we first developed a set of 1,873 highly informative and reliable diagnostic SNPs for these two species to evaluate the degree of admixture between them. Overall, results indicate a high discriminatory power of nuclear SNPs (Fst=0.47, p<0.05) between the two species, unlike mitochondrial DNA ( $\Phi_{ST} = 0.00 \text{ p} > 0.05$ ), which failed to differentiate between these species. We identified four hybrid individuals (~1%) and detected bi-directional introgression between C. galapagensis and C. obscurus in the Gulf of California along the east Pacific coast of the Americas. Importantly, four cases of misidentification were also detected between our target species and two other Carcharhinus species (C. falciformis and C. brachyurus), using mitochondrial control region. Given the morphological similarities between these four species, we emphasize the importance of including a combination of mtDNA and genome-wide diagnostic markers to assess taxonomic identification, detect patterns of hybridisation, and better inform management and conservation of these sharks.

Key words: Elasmobranchs, Single Nucleotide Polymorphisms, hybridisation,

# 20. Genetic diversity and conservation of the misty grouper (Hyporthodus mystacinus) in the Galapagos Islands, Ecuador

Alexandra María Ávila Leoro<sup>1,2</sup>, Carlos Valle<sup>1</sup>, Anna Troya<sup>1</sup> <sup>1</sup> Universidad San Francisco de Quito <sup>2</sup> Oregon State University

#### Contacto email: Alexandra.m.avila@gmail.com

Overfishing is widely recognized as impacting species diversity and abundance, but its effects on marine fish genetic diversity have been largely ignored. The groupers (Serranidae) are a commercially important family of fish in many parts of the world as well as in the Galapagos Islands. Using 12 microsatellites markers, we analyzed 108 fin clips that were collected across 6 local populations, we found high genetic diversity (average of 0.697) and high gene flow for Hyporthodus mystacinus among the localities in the Galapagos Islands. Only 1.57% of the total microsatellite DNA diversity was explained by the variance among population groups, which means there is very little variation among local populations within regions (ALPR 0.65%) and among regions (AR 1.57%) due to great gene flow among the local populations (Fst 0.005, Fis 0.353). The largest proportion of variation was explained by the variance among individuals within local populations (AILP 34.33%) and even greater variability when comparing each individual (WI 63.45%). Since there is not a statistically significant variation between localities, the differences may be explained by variation between individuals. High genetic diversity has traditionally been associated with good health of populations, and would signal a good future for traditional fishing of H. mystacinus. Therefore, for fishing of H. mystacinus to continue at a sustainable level, it is imperative to maintain a high genetic diversity through a good management plan. It is important to conserve genetic diversity since it provides the raw material for the maintenance of species over longer evolutionary time-scales and is also of particular relevance at present in terms of providing the basis for responses to rapid environmental change (e.g. climate), since reduced genetic diversity has been correlated with decreased fitness.

Keywords: grouper, overfishing, genetic variation, population connectivity

#### 21. Oil palm expansion poses a threat to Costa Rican moth assemblages

Aura M. Alonso-Rodríguez<sup>1\*</sup>, Bryan Finegan<sup>2</sup> and Konrad Fiedler<sup>3</sup>

<sup>1</sup> Instituto Internacional de Dasonomía Tropical, Servicio Forestal de Estados Unidos, San Juan, Puerto Rico

<sup>2</sup> Programa de Producción y Conservación en Bosques, Centro Agronómico Tropical de Investigación y Enseñanza (CATIE), Turrialba, Costa Rica

<sup>3</sup> Departamento de Ecología Tropical y Biodiversidad Animal, Universidad de Vienna, Austria

\*autor para correspondencia: aurapr15@gmail.com

Oil palm is one of the most rapidly expanding crops throughout the tropics and is known to cause significant biodiversity loss. Nevertheless, impacts on invertebrates have not been extensively evaluated in the Neotropical region. We assessed geometrid and arctiine moth assemblages in a Costa Rican agricultural landscape, where oil palm plantations are the second most common land cover. Moths were sampled during six months with automatic traps in the interior and margin of oldgrowth forests, young secondary forests and oil palm plantations. Richness and diversity of both taxa were severely reduced in oil palm plantations compared to all other habitats, while only geometrid abundance was significantly higher in the interior of old-growth forests. Species composition was distinct in oil palm and forest interior sites and depicted a gradient of habitat disturbance strongly correlated to vegetation structure. Some arctiine species seem adapted to disturbed habitats, while geometrids were stronaly dependent on old-growth forest, showing higher bioindicator potential. Our results show that oil palm plantations are not a suitable habitat for either pollinator taxa. As oil palm cropland continues to expand, conservation strategies should focus on protecting old-growth forest remnants, as well as forest regrowth and structural complexity of degraded habitats.

Keywords: moth assemblages, oil palm plantations, habitat disturbance, Neotropics, Costa Rica

#### 22. How important are mangrove small-scale fisheries in the Eastern Pacific Ocean?

<u>Gustavo A. Castellanos-Galindo</u>, Lotta C. Kluger, Matthias Wolff Leibniz Centre for Tropical Marine Research (ZMT), Bremen, Germany Corresponding author: gustavoa80@yahoo.com

Mangroves on the western coast of Latin America represent 10% of the world's mangroves. Despite localized anthropogenic interventions, mangrove ecosystems in this isolated marine region known as the tropical eastern Pacific (TEP), remain a major source of food and income for people inhabiting the coastal areas of 10 countries. Here, we review the state of knowledge on mangrove artisanal fisheries of the region by documenting the principal stocks harvested, the calculated economic value of these fisheries, how some of these stocks are currently managed and how the different mangrove social-ecological systems are structured. The most conspicuous mangrove-associated species harvested in the TEP are the low trophic level mangrove cockle Anadara tuberculosa and the semi-terrestrial mangrove crab Ucides occidentalis. In addition, several artisanal fleets operate in the vicinities of mangroves targeting mangrove-estuarine dependent fishes and crustaceans. The value of manarove fisheries in the TEP ranges from 175 to 37500 US\$ ha<sup>-1</sup> yr<sup>-1</sup>. Fisheries management of mangrove-associated resources in the region is often absent or weakly enforced. Many MPAs in the region include mangroves within their limits but their effectiveness is unclear. The most important fisheries resources are usually considered over-exploited despite the fishery remaining active and apparently profitable. The structure of mangrove social-ecological systems in the TEP is highly heterogeneous and conditioned by the environmental settings, the degree of coastal development, and the countries' dependence on fisheries resources. Given that most of these fisheries target the same resources, regional strategies, that factor the heterogeneous character of these systems, are required.

Keywords: mangrove fisheries, Anadara tuberculosa, Ucides occidentalis, penaeid shrimps, tropical eastern Pacific, resource management, social-ecological system

# 23. Integrating research, outreach activities and education to conservation of an isolated bottlenose dolphin population in Bocas del Toro, Panama

Barragán-Barrera D.<sup>1, 2</sup>\*, Pérez-Ortega B.<sup>3,4</sup>, Quiñones-Lebrón S.<sup>3,5</sup>, Kassamali-Fox A.<sup>3</sup>, Gamboa-Poveda M.<sup>3,6</sup>, Palacios-Alfaro D.<sup>7</sup>, Casas J.J.<sup>3,8</sup>, Trejos-Lasso L.<sup>3,8,9</sup>, Polo-Silva C.<sup>10</sup>, Riet-Sapriza F.<sup>1</sup>, Luna-Acosta A.<sup>11</sup>, Caballero S.<sup>1</sup> & May-Collado L.<sup>3, 12\*</sup>

<sup>1</sup> Laboratorio de Ecología Molecular de Vertebrados Acuáticos – Universidad de los Andes, Bogotá, Colombia <sup>2</sup> Fundación Macuáticos Colombia, Medellín, Colombia

Fundacion Macuaticos Colombia, Medellin, Colombia <sup>3</sup> Panacetacea

<sup>4</sup> Biology Department and Redpath Museum, McGill University – Montréal, Canadá <sup>5</sup> Jovan Hadži Institute of Biology, ZRC SAZU, Slovenia

<sup>6</sup>Asociación Costa Rica por Siempre, San José, Costa Rica <sup>7</sup> Fundación Keto, San José, Costa Rica

<sup>8</sup> Universidad Marítima Internacional de Panamá, Ciudad de Panamá, Panamá

<sup>9</sup> Autoridad de los Recursos Acuáticos de Panamá, Ciudad de Panamá, Panamá
 <sup>10</sup> Facultad de Ciencias Naturales e Ingeniería, Departamento de Ciencias

Biológicas y

Ambientales, Programa Biología Marina – Universidad de Bogotá Jorge Tadeo Lozano, Santa Marta, Colombia

<sup>11</sup> Departamento de Ecología y Territorio, Facultad de Estudios Ambientales y Rurales – Pontificia Universidad Javeriana, Bogotá, Colombia

<sup>12</sup> University of Vermont, Burlington, VM, USA

<u>\*autores correspondientes:</u>

<u>lmaycollado@gmail.com</u>

daliac.barraganbarrera@gmail.com

In 2006 the Panamanian government approved the extraction of 85 bottlenose dolphins from the Bocas del Toro-BDT population (by Ocean Embassy) to be sold to dolphinariums. The extraction was justified on two unsupported assumptions: the population was large, and it likely had constant gene flow with oceanic dolphin populations. At that time, photo-ID and baseline data indicated the opposite: the population was less than 200 dolphins with high levels of fidelity. Our 15 years of monitoring efforts and recent genetic and ecotoxicological analyses, indicate the Bocas bottlenose dolphin population is strictly inshore and genetically isolated from the rest of the Caribbean. This makes these animals vulnerable to several human activities, the most important is tour-boat traffic. Tour boats tend to congregate in important nursing greas exposing mothers and calves to high levels of noise and intense interactions. The increase of boat presence resulted in avoidance strategies by the dolphins, which significantly decreased the time dedicated to biologically important behaviors such as foraging. This information was presented in 2012-2015 to the International Whaling Commission, which encouraged the involvement of the Panamanian government in establishing measures to reduce the impact of whale watching. Since 2014, our team has taken the lead in working with governmental agencies and NGOs to train tour captains and educate the public, in an effort to minimize the impact on these animals. Together, research, outreach and educational activities alongside the local community have resulted in participatory conservation planning to properly manage these animals and protect their habitat.

Keywords: *Tursiops truncatus*, Bocas del Toro, Caribbean, dolphin-watching, conservation.

# 24. Long-term monitoring of the Coiba howler monkey Alouatta coibensis coibensis and other mammals from Coiba Island, Coiba National Park, Republic of Panama

#### Méndez-Carvajal P.

Fundación Pro-Conservación de los Primates Panameños (FCPP), Coiba AIP y Universidad de Panamá, Escuela de Biología, Departamento de Fisiología y Comportamiento Animal, República de Panamá \*Autor para correspondencia: mendezp@fcprimatespanama.org

The Coiba National Park is home to several endemic species of mammals such as the howler monkey Alouatta coibensis coibensis, white-tail deeer Odocoileus virginianus rothschildi, bats Molussus coibensis, and the Coiban agouti Dasyprocta coibae. These remains on the island despite its status as a penal colony since 1919. In 2005 the island was formally declared as a National Park by the Environmental Ministry of Panama, and five years later we conducted the first complete primate population survey and surveyed mammal biodiversity. Coiba Island is located in the Panamanian west pacific (7°28'N 81°47'W / 7.467°N 81.783°O). Currently 75% of the vegetation is protected, but some human disturbance has been described due to the interest in using Coiba for tourism. Our project was supported by the Rufford Small Grant 2010 to measure the impacts of feral cattle on the forest understory. We also observed a high density of hematophagous bats and low density of howler monkeys, calling attention to these issues as indicators of conservation needs. Recently we added a camera trap system to monitor understory mammals and survey the canopy to detect arboreal mammals not seen before using the Orion Camera System (OCS) at 12 m high with Bushnell Trophy Cam models. The aims of this project are to integrate ecological knowledge and behavior of mammals living in Coiba to better understand their population dynamics living on a continental island with limited resources. Here we present some preliminary results related to direct/indirect observation of species detected and expectations for their conservation.

Key words: Coiba howler monkey, mammals, ecological behaviour, population, Coiba Island, Panama

Keywords: mammal diversity, photo-trapping, canopy ecosystems

# 25. What do we know about the endemic rodents of Colombia? Implications for their conservation

<u>Ramírez-Chaves, H. E.</u><sup>1\*</sup>, Noguera-Urbano, E. A.<sup>2,3</sup>, Morales-Martínez, D.<sup>4</sup>, Zurc, D.<sup>5</sup>, Vargas-Arboleda, A. F.<sup>6</sup>, Mantilla-Meluk, H.<sup>3,6</sup>
 <sup>1</sup> Departamento de Ciencias Biológicas, Facultad de Ciencias Exactas y Naturales, Universidad de Caldas, Manizales, Colombia
 <sup>2</sup> Instituto de Investigación de Recursos Biológicos, Alexander von Humboldt. Avenida Paseo Bolívar (Circunvalar) 16-20, Bogotá, D.C., Colombia.
 <sup>3</sup> Sociedad Colombiana de Mastozoología. Bogotá, Colombia.
 <sup>4</sup>. Grupo de Fauna, Programa de Ecosistemas y Recursos Naturales Instituto Amazónico de Investigaciones científicas SINCHI.
 <sup>5</sup> Museo de Ciencias Naturales de La Salle, Instituto Tecnológico Metropolitano, Calle 54A # 30-01, Medellín, Colombia.
 <sup>6</sup> Centro de Estudios de Alta Montaña (CEAM), Colección de Mamíferos Universidad del Quindío (CMUQ)
 \*corresponding author: hector.ramirez@ucaldas.edu.co

The mammal richness of Colombia (530 species) has positioned the country as the sixth alobally. Of this richness, almost 64.7% is represented by bats (Chiroptera: 209 species) and rodents (Rodentia: 134 species). Rodents represent the order of mammals with the highest number of endemic species (30) in Colombia. However, knowledge on these species is incipient in most cases, or is dispersed in the literature. This has hindered the development of concise assessments of the current status of their populations. To analyze the state of knowledge of the endemic rodents of Colombia, we conducted an exhaustive literature search (until 2017) and reviewed voucher specimens in national and international museums. In addition, we present observations on their level of threat based on the IUCN criteria. Ecological and systematic studies are missing for almost all species of endemic rodents of Colombia. Information is compiled for only 2 species (Olallamys albicaudus and Santamartamys rufordorsalis), while only 4 species, Thomasomys bombycinus, Coendou vestitus, Thomasomys monochromos, and S. rufordorsalis, are considered as Vulnerable, Endangered and Critically Endangered at the national or global level. 6 species lack IUCN assessments, while 10 are found to be Data Deficient. Urgent actions are required to evaluate the threaten status of the remaining 8 endemic rodent species of Colombia, which have not been registered in the last 30 years, and knowledge on their natural history, phylogenetic position and ecology is null.

Keywords: Andes, distribution, conservation, ecology, natural history.

# 26. Generating baseline data to conserve small cetaceans in La Guajira (Colombian Caribbean)

<sup>1,4\*</sup>Farías-Curtidor, N., <sup>2</sup>Chávez-Carreño, P. A., <sup>2</sup>Mesa-Gutiérrez, R. A., <sup>3</sup>Duarte, A.,
 <sup>3,4</sup>Barragán-Barrera, D., <sup>5,6</sup>Correa-Cárdenas, C., <sup>7</sup>Polo-Silva, C., <sup>8</sup>Luna-Acosta, A.,
 <sup>1</sup>Jiménez-Pinedo, C., <sup>9</sup>Ayala-Mendoza, R. <sup>3</sup>Caballero, S.

<sup>1</sup> Investigador independiente

<sup>2</sup> Nicholas School of the Environment, Duke University, Durham, NC, USA
 <sup>3</sup> Laboratorio de Ecología Molecular de Vertebrados Acuáticos (LEMVA),
 Department of Biological Sciences, Universidad de los Andes, Bogotá, Colombia
 <sup>4</sup> Fundación Macuáticos Colombia, Medellín, Colombia

<sup>5</sup> Facultad de Ingeniería y Ciencias Básicas, Departamento de Ciencias Naturales, Universidad Central, Bogotá, Colombia.

<sup>6</sup> Departamento de Ciencias Básicas, Universidad de La Salle, Bogotá, Colombia. <sup>7</sup> Facultad de Ciencias Naturales e Ingeniería, Departamento de Ciencias Biológicas

Ambientales, Programa Biología Marina – Universidad de Bogotá Jorge Tadeo Lozano, Santa Marta, Colombia

<sup>8</sup> Departamento de Ecología y Territorio, Facultad de Estudios Ambientales y Rurales – Pontificia Universidad Javeriana, Bogotá, Colombia

<sup>9</sup> Pescador local

\*Autor para correspondencia: <u>nohefa@gmail.com</u>

La Guajira region in the Colombian Caribbean holds a high biodiversity and stable marine ecosystems. However, there are serious information gaps regarding the basic biology and conservation status of marine mammals. In order to collect baseline data and skin samples of odontocetes in La Guajira, surveys on board a small wooden fishing boat were conducted in May 2013, 2014, 2015, 2018 and June 2016. A total of 1900 nautical miles have been covered following transects in zigzag parallel to the coastline from 7 am to 5 pm. We recorded 34 sightings of six different species and collected 40 skin samples: Delphinus sp. (n=10), Pseudorca crassidens (n=1), Stenella frontalis (n=15), S. longirostris (n=2), Steno bredanensis (n=4), and Tursiops truncatus (n=8). Genetic and photo-ID analyses confirmed Delphinus sp. in Colombian waters. Genetic findings showed high connectivity between some dolphin species from the Caribbean with other areas in the Atlantic (S. frontalis, S. bredanensis, and T. truncatus). Ecotoxicological findings indicated moderate mercury bioaccumulation in skin samples of all species found, as well as similar isotopic signatures, which means they are feeding on similar prey. This situation raises concerns about the toxicological status of fish and the health of local communities who consume them. Therefore, we have conducted environmental education with children and fishermen, also because they are not aware about ecological threats related to habitat degradation. Despite our findings suggesting that La Guajira is an important transit area for dolphins, long-term monitoring is needed to identify conservation status for dolphins in this area.

**Key words**: La Guajira, baseline data, odontocetes, skin samples, conservation

# 27. Population trends of Jaguar (*Panthera onca*), other felines and their potential prey in Santa Rosa National Park, Guanacaste, Costa Rica

Víctor Montalvo Guadamuz<sup>1,2\*</sup>, Carolina Sáenz Bolaños<sup>1,2</sup>, Shirley Ramírez Carvajal<sup>1</sup> & Eduardo Carrillo Jiménez<sup>1</sup>

<sup>1</sup>Instituto Internacional en Manejo y Conservación de Vida Silvestre, Universidad Nacional, Apdo. 1350-3000, Heredia, Costa Rica

<sup>2</sup>Department of Environmental Conservation, University of Massachusetts, Amherst, Massachusetts 01003, USA.

\*Autor corresponsal: victor.montalvo.guadamuz@una.cr, vmontalvog@gmail.com,

Santa Rosa National Park (SRNP) protects the largest remnant of dry forest ecosystem in Costa Rica. These lands were used for livestock 40 years ago, however continuous reforestation efforts and fire control have increased the vegetation cover. In light of this, it is necessary to determine whether management actions have been effective to meet conservation objectives. This study used large carnivore species; jaguar (Panthera onca), puma (Puma concolor), ocelot (Leopardus Pardalis) and their prey to show population trends between two sample periods 2001-2011. Here, we used systematic track-count surveys across seven trails, showing an upward trend for large carnivores between the assessed periods. Jaguars showed an increasing pattern whereas puma track surveys tended to decrease and ocelots kept stable. With regard to potential prey, a decreasing trend was observed for frugivores and herbivores, in contrast to an increase after 10 years for omnivorous prey species. Comparisons throughout the sample periods showed population changes over the 10-year period at SRNP, finally suggesting that systematic track-count surveys are effective to track species abundance and incur lower costs than other techniques such as camera trapping or telemetry.

Keywords: Panthera, relative abundance, prey, feline, restoration, Santa Rosa National Park.

# 28. Endemic bats (Mammalia: Chiroptera) of Colombia: state of knowledge, distribution, and conservation

<u>Ramírez-Chaves, H. E.</u><sup>1\*</sup>, Noguera-Urbano, E. A.<sup>2,3</sup>, Morales-Martínez, D.<sup>4</sup>, Zurc, D.<sup>5</sup>, Vargas-Arboleda, A. F.<sup>6</sup>, Mantilla-Meluk, H.<sup>3,6</sup>
<sup>1</sup> Departamento de Ciencias Biológicas, Facultad de Ciencias Exactas y Naturales, Universidad de Caldas, Manizales, Colombia
<sup>2</sup> Instituto de Investigación de Recursos Biológicos, Alexander von Humboldt. Avenida Paseo Bolívar (Circunvalar) 16-20, Bogotá, D.C., Colombia.
<sup>3</sup> Sociedad Colombiana de Mastozoología. Bogotá, Colombia.
<sup>4</sup>. Grupo de Fauna, Programa de Ecosistemas y Recursos Naturales Instituto Amazónico de Investigaciones científicas SINCHI.
<sup>5</sup> Museo de Ciencias Naturales de La Salle, Instituto Tecnológico Metropolitano, Calle 54A # 30-01, Medellín, Colombia.
<sup>6</sup> Centro de Estudios de Alta Montaña (CEAM), Colección de Mamíferos Universidad del Quindío (CMUQ)
\*corresponding author: hector.ramirez@ucaldas.edu.co

This high bat diversity is represented by nine families and 70 genera. A total of eight species of the families Emballonuridae (n = 1) and Phyllostomidae (n = 7), are listed as endemic to the country. In spite of the relevance of bat diversity to Colombia, little is known of these endemic species known mostly from the type locality (n = 4), or its taxonomic status is uncertain (n = 2). Here we compile available information of endemic bats from Colombia and provide new information on their distribution and conservation. The most studied species was Lonchorhina marinkellei with 14 publications. The only distribution pattern observed for the species evaluated was for Carollia monohernandezi and Vampyressa sinchi, which might overlap distributions on the eastern slopes of the Eastern Cordillera. Most endemic species are from the Andean and inter-Andean regions of the country (n = 6). At the national level, there are no endemic species in any threatened category, however at least one species (Lonchorhing marinkellei) is considered as Vulnerable (VU) and one (Saccopteryx antioquensis) as Endangered (EN) by the International Union for Conservation of Nature – IUCN. Additional field work to obtain new records of these endemic species in Colombia is needed and molecular tools should be used to address controversial issues in taxonomy and systematics. With this novel information, the conservation category for all endemic species should be re-assessed.

Keywords: Andes, Emballonuridae, Phyllostomidae, South America, Threaten category.

#### **POSTER SESSIONS**

#### 1. Gut microbiota of Andean Bears: A novel approach for examining health and habitat quality of captive and wild individuals

Borbón, Andrea<sup>1</sup> & Pitta, María José<sup>2</sup>.

- 1. Grupo de Investigación en Biología Computacional y Ecología Microbiana, Universidad de los Andes, Bogotá, Colombia
- 2. Observatorio de Seguridad Alimentaria (OBSSAN), Facultad de Medicina, Universidad Nacional de Colombia Sede Bogotá, Colombia.

Correspondencia: ad.borbon174@uniandes.edu.co, mjpittap@unal.edu.co

The Andean Bear is an endemic and Vulnerable species of the tropical Andes whose populations are under strong pressure by habitat degradation and illegal hunting. Its diet is represented by the consumption of a vast diversity of plants. However, several ex-situ conservation strategies do not fully satisfy their nutritional needs. In mammals, the gut microbiota plays a crucial role in the nutrients metabolism and health of the host. Environmental perturbations such as diet changes (i.e. anthropogenic feeding, habitat degradation, etc.) can influence the diversity of the gut microbiota and thus the nutritional health's host. The goal of this study was to determine how habitat degradation and captivity maintenance modify the healthy gut microbiota of Andean bears. Fecal samples from 70 bears including wild, captive and wild cubs raised in captivity were collected. The DNA was extracted and further metagenomics methods were implemented to characterize their gut microbiota. We found that the microbial diversity is highly reduced in captive animals, which could make the animals more susceptible for suffering infectious or other nutrition-related diseases. The wild cubs maintained in captivity progressively lose the microbial diversity acquired in the wild. Also, the found metabolic potential for degrading plant material supports their mostly herbivorous lifestyle but are dramatically reduced in captive animals. The monitoring of the gut microbiota in both wild and captive bears is a promising tool to strengthen existing conservation efforts, highlighting the importance of adequate diet and nutritional outcomes for wild bears under a scenario of habitat degradation and fragmentation.

**Keywords**: Andean bear, gut microbiota, metagenomics, captivity management, nutrition.

#### 2. Temporal segregation of jaguar, puma and ocelot in two tropical habitats of Costa Rica

<u>**Hansel Herrera**</u><sup>1\*</sup>, Elpis J. Chávez<sup>2</sup>, Luis D. Alfaro<sup>3</sup>, Todd Fuller<sup>4</sup>, Victor Montalvo<sup>3,4</sup>, Flávio Rodrigues<sup>5</sup> & Eduardo Carrillo<sup>3,4</sup>

<sup>1</sup>Iniciativa Osa & Golfito, Woods Institute for the Environment, Stanford University, Puntarenas, Costa Rica.

<sup>2</sup>Centro de Rescate de Especies Marinas Amenazadas, Heredia, Costa Rica. <sup>3</sup>Instituto Internacional en Conservación y Manejo de Vida Silvestre, Universidad Nacional, Heredia, Costa Rica.

<sup>4</sup>Department of Natural Resources Conservation, University of Massachusetts, Amherst, USA.

<sup>5</sup>Universidade Federal de Minas Gerais, Dept. Biologia Geral. Minas Gerais, Brasil. \*corresponding author: <u>bluecloudcr@gmail.com</u>

Temporal segregation of daily activity patterns is considered one of the principal mechanisms facilitating the coexistence of competing species. Jaguars (Panthera onca), pumas (Puma concolor) and ocelots (Leopardus pardalis) are sympatric predators whose diets frequently overlap. We evaluated if temporal separation existed among them and if their activity patterns were related to that of particular prey in both the tropical dry and rainforests of Costa Rica. We used camera trap records to estimate the activity schedules of these predators and their prey. We used the coefficient of overlapping ( $\Delta$ ; ranging from 0 to 1) to quantify the temporal interactions between predators and prey, and calculated confidence intervals from bootstrapped samples. Strong temporal overlap occurred among the three felids ( $\Delta$ = 0.63 - 0.82) in both dry and rainforests. However, a greater temporal separation was observed between the closest competitors (jaguar and puma, puma and ocelot). Jaguar and puma had a strong temporal overlap with medium and largesized prey, while ocelots' activity matched that of small-sized prey. High overlapping coefficients among the felids suggests that temporal segregation is not the main mechanism facilitating their coexistence in these areas. However, fine-scale or spatiotemporal differences in their activity patterns might contribute to their coexistence in tropical environments.

Key words: activity patterns; coexistence; Corcovado National Park; Guanacaste Conservation Area; interference competition.

#### 3. Comparative study of dragonfly diversity in habitats affected by artisanal mining and outreach in Afro-communities of Chocó, Colombia Montes-Fontalvo J<sup>1,2\*</sup>

<sup>1</sup> Semillero de Sistemática y autoecología de insectos acuáticos, SAIA, Universidad del Atlántico <sup>2</sup>Universidad Central de Venezuela \*corresponding author: jenileemontes@gmail.com

In order to communicate with native families regarding the problems caused by artisanal mining in the municipality of Tutunendo (Chocó-Colombia), we carried out a the first description of dragonfly biodiversity in the region. Taking into account that this aroup of insects has been used as bioindicators of water quality, we compared communities of this group of insects among habitats within the same watershed that had experienced different durations and intensities of artisanal mining. The main objective was to evaluate water health and its impacts on dragonfly communities, with the secondary objective of developing an eduational community program aimed at both adult and child populations. We collected and made field direct observations of immature individuals (larvae) and other associated macroinvertebrates, and also performed opportunistic sampling of adults with an entomology net. Abundance and diversity of dragonflies were correlated with environmental parameters and a physicochemical water analysis for each microhabitat identified in the ecosystem. Based on these results, indicator species were identified as having limited tolerance to environmental damage and thus could serve in non-expert biomonitoring, because they are easily identified in the field. In the long term, this project may form the basis of a community biomonitoring plan in the Chocó region.

Keywords: Dragonflies, Artisanal mining, Insects, Community biomonitoring, water, Conservation.

#### 4. Mammal diversity and environmental education in the buffer area of the Amotapes-Manglares Biosphere Reserve, Peru

García-Olaechea, A1,2,\*, Vega, Z.1, Hurtado C.1 y Rengifo, E1

<sup>1</sup> Centro de Investigación Biodiversidad Sostenible - BioS, Perú

<sup>2</sup> PPG Ecologia e Conservação da Biodiversidade, Universidade Estadual de Santa

Cruz, Brasil

\*Correspondence author: a.garcia.olaechea@gmail.com

The buffer areas around Natural Protected Areas are the first barriers between the forest and anthropogenic activities. For this reason, assessing the biodiversity inside and outside of the Natural Protected Areas, as well as environmental education activities, are the main strategies to guarantee wildlife conservation. Between February and November 2017, we evaluated mammal diversity in the dry forest of the Amotapes-Manalares Biosphere Reserve (AMBR), northwestern Peru. We used mist nets and acoustic records to register bats, Victor and Sherman traps for rodents and marsupials, and camera traps and direct observations to register medium to large-sized mammals. Also, to facilitate environmental education activities and research in AMBR, we built a Visitor Center with the support of the Ecotourist Association of Rica Playa. We recorded 30 mammal species, two of which are endemic to the dry forest of Ecuador and Peru, one species is categorized as Vulnerable, three species as Near Threatened, and two species as Data Deficient. Additionally, we recorded new species for the AMBR: the bats Eumops cf. perotis, Nyctinomops aurispinosus, Nyctinomops laticaudatus, Nyctinomops macrotis, Promops centralis and Tadarida brasiliensis and the pampas cat Leopardus colocolo. For the latter species, the AMBR would be its northernmost limit of its distribution in the Pacific dry forest. Furthermore, in the Visitor Center (where activities continue) and in the local school of Rica Playa, we conducted environmental education workshops for schoolchildren and adults, highlighting mammal diversity and its importance for the ecosystem.

Key words: Dry forest, Leopardus colocolo visiting center, new records and Nyctinomops spp.