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Objectives and research interests

My research is focused on conservation physiology and ecotoxicology. These disciplines study the organisms' physiological adaptations to challenging environmental conditions using an integrative approach. I am interested in applying physiological knowledge and tools to understand and predict how organisms, populations, and ecosystems respond to environmental change and stressors. Understanding the physiological mechanisms underlying stress responses is fundamental to be able to predict, prevent and mitigate anthropogenic effects on wildlife, and they could be key tools to support management decisions.

To address these topics I combine field and laboratory based experiments looking at effects of stressors at different levels of biological organizations. The study of behavior is a main component of my research projects. I have studied a diverse set of species including bees, crickets, fish and bats. I have been involved in research projects addressing conservation issues of elasmobranchs community such as incidental fishing and mercury bioaccumulation in the Pacific of Costa Rica. For my M.Sc. thesis, I performed an integral assessment of the toxic effects of a pesticide on a native freshwater fish species from a molecular, physiological and behavioral perspective. Currently I am looking at the sublethal effects of neurotoxic pesticides in vertebrate pollinators such as bats and hummingbirds.

Degrees

Bachelor in Biology | August 2013 | Universidad de Costa Rica

Master in Biology with Honors | August 2017 | Universidad de Costa Rica

Languages

- Spanish: 100 % (native)
- English: 90 % (TOEFL, 2015)
- German: basic level (B1 2015)

Research and field skills

- Field sampling methods: live-trapping, mist-netting, banding, tagging, tissue sampling (blood, hair, swabs)
- Metabolic rate measurement techniques.
- Ecotoxicological biomarker measurement and analysis.
- Intra and extracellular electrophysiological recordings.
- Analysis of animal behavior (Etholog software, Python, Mathematica).
- Bioacoustic analyses (Avisoft, Kaleidoscope).
- Analysis of trophic ecology using stable isotopes.
- Immunocytochemistry and immunohistology techniques.
- Use of fluorescence and confocal microscopy and image processing.
- Data analysis: R, Python, SAS
- Geographic information Systems software (ArcGIS, QGIS).
- Tropical bats identification and handling.
- Tropical Fish identification.
- PADI Open Water diving license.
- Experience in underwater visual census and health assessments of reef communities.

Work and research experience

2018

Researcher
Ecology and Evolutionary Biology Department
University of Toronto

Project: Potential of hair cortisol as biomarker of stress in bats
Collaboration with Reproductive Endocrinology laboratory at Toronto Zoo.

- Sampling collection and biochemical analysis

2017-2018	**Researcher** Ecology and Evolutionary Biology Department University of Toronto	**Project:** Effects of neonicotinoids on hummingbirds Project coordinator: Kenneth Welch PhD. and Christine Bishop PhD Environment and Climate Change Canada. -Pilot project experimental design and execution dose-effect experiments, Physiological measurement, Behavior experiments.
2016-2017	**Research asssistant** IRET-UNA (Instituto Regional de Estudios en Sustancias Tóxicas-Universidad Nacional)	**Project:** Evaluación del riesgo ecológico de la escorrentía de plaguicidas usados en la agricultura hacia el Río y la Laguna Madre de Dios en la zona del Caribe, Costa Rica. *Ecological risk assessment of agricultural pesticides run off in the Madre de Dios River and lagoon, Caribbean coast of Costa Rica.* **Project coordinator:** Margaret Pinock, PhD.,Freylan Mena MSc. -Field sample collection. -Biochemical biomarkers analyses
2015-2016	**Researcher** UCR-INCOPESCA (Instituto Costarricense de Pesca y Acuicultura) Collaboration with government institution.	**Project**: Estimación de la talla de madurez sexual de seis especies de interés comercial en el Pacífico de Costa Rica. *Estimation of sexual maturity size of six commercial fish species in the Pacific coast of Costa Rica.* **Project coordinators**: Ingo Wehrtmann, Mario Espinoza - Collection of gonad samples from fish species on the field. - Morphological and histological analysis of sexual maturity.
2015	**Intern** Institute of Neurobiology, Universität Ulm,Germany	**Project**: Influences of octopamine on the aggressive and reproductive behavior of female crickets (*Gryllus bimaculatus*). -Effects of *corpora allata* disruption in aggressive and reproductive behavior of female crickets (*Gryllus bimaculatus*) **Project coordinator**: Dr.rer.nat Andrea Wirmer - Behavioral tests (phonotaxis). - Inmunocytochemical preparation and image processing. **Project:** Do neonicotinoid pesticides affect the orientation accuracy in honey bees (*Apis mellifera*)? **Project coordinator**: Dr.rer.nat Stefan Jarau -Behavioral tests and data analysis.
2014	**Research assistant**	**Project**: Programa de monitoreo de arrecifes en el archipiélago las perlas e Isla Coiba, Panamá. *Monitoring program of reefs in the archipelago las Perlas and Coiba island, Panama.* **Project coordinator**: Conservation International Latin America (CI) - Underwater visual census of reef fish and invertebrates

2013	**Research assistant** Center for Marine Research and Limnology, University of Costa Rica (CIMAR-UCR)	**Project**: Monitoring of reefs in the Pacific coast of Costa Rica **Project coordinator**: Juan José Alvarado, PhD. CI, - Underwater visual census of reef fish
2012-2015	**Research assistant** The Billfish Foundation, CIMAR-UCR	**Project**: Evaluation of fishing resources in Golfo Dulce, Pacific of Costa Rica. **Project coordinator**: Helena Molina Ureña, Ph.D. - Underwater visual census of reef fish - Collection, identification and measurement of fish and crustacean species from scientific trawling and gill net samples
2010-2012	**Research assistant** Unit of Fisheries Research, CIMAR- UCR	**Project**: Evaluation of species associated to shrimp trawling by-catch in the Pacific of Costa Rica **Project coordinator**: Ingo Wehrtmann, Dr.rer.nat - Identification and measurement of teleost and elasmobranch species. - Extraction and preparation of muscle samples for chemical analysis. - Identification of stomach contents from elasmobranch species.

Teaching experience

2018	Teacher assistant University of Toronto at Scarborough	Animal exercise **Course coordinator:** Kenneth Welch, PhD. - Weekly tutorials about animal exercise physiology
2017	Teacher assistant University of Toronto at Scarborough	Animal Physiology Laboratory **Course coordinator:** Kenneth Welch,PhD. - Practical session preparation and students advisory
2016-2017	Professor Faculty of Medicine, Universidad de Ciencias Médicas (UCIMED), Costa Rica	Human Physiology course **Course coordinator**: José Ernesto Sánchez, M.D. - Preparation of lectures and practical sessions - Preparation and marking of tests
2016	Instructor School of biology University of Costa Rica	Ecology and conservation of tropical reef fish practical course **Course coordinator**: Helena Molina Ureña, PhD - Set up and leading practical sessions - Supervising field work in tropical fish student research.

2013-2015	Teaching assistant School of Biology University of Costa Rica	Animal physiology laboratory **Instructor**: Adarli Romero, PhD - Preparation and marking of tests - Preparation of practical sessions
2011-2014	Instructor School of biology University of Costa Rica	General biology laboratory **Course coordinator**: Adarli Romero, PhD - Instruction during laboratory sessions - Preparation and marking of tests

Publications

Sandoval-Herrera, N. I., J. S. Vargas-Soto, M. Espinoza, T. Clarke and I. S. Wehrtmann. 2016. Mercury levels of four elasmobranch species along the Pacific coast of Costa Rica, Central America.Regional Studies of Marine Science 3: 254-261. doi: 10.1016/j.rsma.2015.11.011

Sandoval-Herrera ,N.I., F. Mena,M. Espinoza and A.Romero-Vasquez.2017. Ecotoxicological assessment of the pesticide ethoprophos in a tropical freshwater fish: biochemical, physiological, and behavioral approach. Submitted to Nature Scientific Reports Journal

Complementary courses

2017	Introduction to Python for scientific programing	SCINET, University of Toronto
2016	Fisiología de los equinodermos Echinoderm physiology	Dra.Tamara Rubilar Costa Rica - Congreso Latinoamericano de Equinodermos *Latin American Echinoderm Congress*
2015	Food web ecology	Ph.D. Kirk Winemiller Universidad de Costa Rica - IV Simposio latinoamericano de ictiología.
2015	Métodos para estudiar el movimiento y uso de hábitat en peces: aplicaciones para el manejo y conservación. *Methods to study movement and habitat use in fish: application for managment and conservation*	PhD. Mario Espinoza Universidad de Costa Rica - IV Simposio latinoamericano de ictiología.
2015	Behavior physiology	Lecture and practical course. Master program. Institute of Neurobiology, Universität Ulm, Germany
2015	Histology techniques, practical course	Master program. Institute of Neurobiology, Universität Ulm. Germanv
2015	Isótopos estables como herramienta de investigación en especies marinas. *Stable isotopes as a tool in marine research*	Dr. Sebastian Lopez Clarian-Universidad Andres Bello CIMAR, Universidad de Costa Rica

2014	Isotopos estables y su aplicación en ecología de organismos marinos *Stable isotopes and their application on marine organism ecology*	Universidad EAFIT-Medellin, Colombia IV Encuentro Colombianos sobre Condrictios
2013	Monitoreo submarino y manejo de la información *Underwater monitoring and data analysis*	Escuela de Biología, Universidad de Costa Rica
2012	Fisheries ecology and management	The Billfish Foundation, Pronature, UNIP-CIMAR
2012	Ecología y conservación de peces de arrecifes tropicales	Escuela de Biología, Universidad de Costa Rica
2011	Taller de técnicas de montaje en parasitología *Parasitology techniques*	Centro de investigaciones en estructuras microscópicas (CIEMIC)
2011	Introduction to the parasites of sharks and rays	Lecture and Training. UNIP-CIMAR
2010	Primeros auxilios en fauna silvestre *First aids for wildlife*	Universidad Nacional Escuela de Medicina Veterinaria

Workshops

2017 Impacts and Alternatives of Systemic pesticides Symposium. York University, Canada.

2016 Presentación oral: Taller del acuerdo MINAMATA, Costa Rica
(*Oral presentation: MINAMATA convention on mercury, Costa Rica*)

2015 Organizing committee member: I Congreso Costarricense y IV Simposio Latinoamericano de Ictiología, San Jose, 2015.
(*IV Latin American Symposium of Ichthyology, San José, 2015)*

2014 IV Encuentro Colombianos sobre Condrictios. Presentacion oral: Contenido de mercurio en cuatro especies de elasmobranquios en el Pacífico de Costa Rica. EAFIT, Medellín, Colombia.
(IV Colombian meeting about chondrichthyans. Oral presentation: Mercury levels of four elasmobranch species along the Pacific coast of Costa Rica. Medellín, Colombia)

2013 Taller interinstitucional de implementación de medidas CITES para el tiburón martillo, tiburón punta blanca oceánico y la manta raya
(*Interinstitutional workshop on implementation of CITES regulations for hammerhead shark, oceanic whitetip shark and manta rays*)

2014 IV jornada de investigación sobre el Pacifico costarricense
(*IV Workshop of research in the Pacific coast of Costa Rica, UCR. Reproductive ecology of shallow water ray species from the Eastern Tropical Pacific*)

2011 Elasmobranquios demersales del Pacífico de Costa Rica: Identificación de hábitats esenciales y desarrollo de estrategias de manejo
(*Demersal elasmobranchs in the Pacific of Costa Rica: identification of essential habitats and development of management strategies*)

Awards

2018 Society of Environmental Toxicology and Chemistry (SETAC), Annual conference student award

2017 Ecology and Evolutionary Biology Department, University of Toronto, International student Fellowship

2017 Thesis with honours, Sistema de estudios de posgrado Universidad de Costa Rica

2015 DAAD Internship Scholarship, Universität Ulm, Germany

2015 Economic support, Vicerrectoría de Investigación, Universidad de Costa Rica

2014 Economic support, Escuela de biología, Universidad de Costa Rica (EB-213-2015.)